The OIL AND GAS JOURNAL

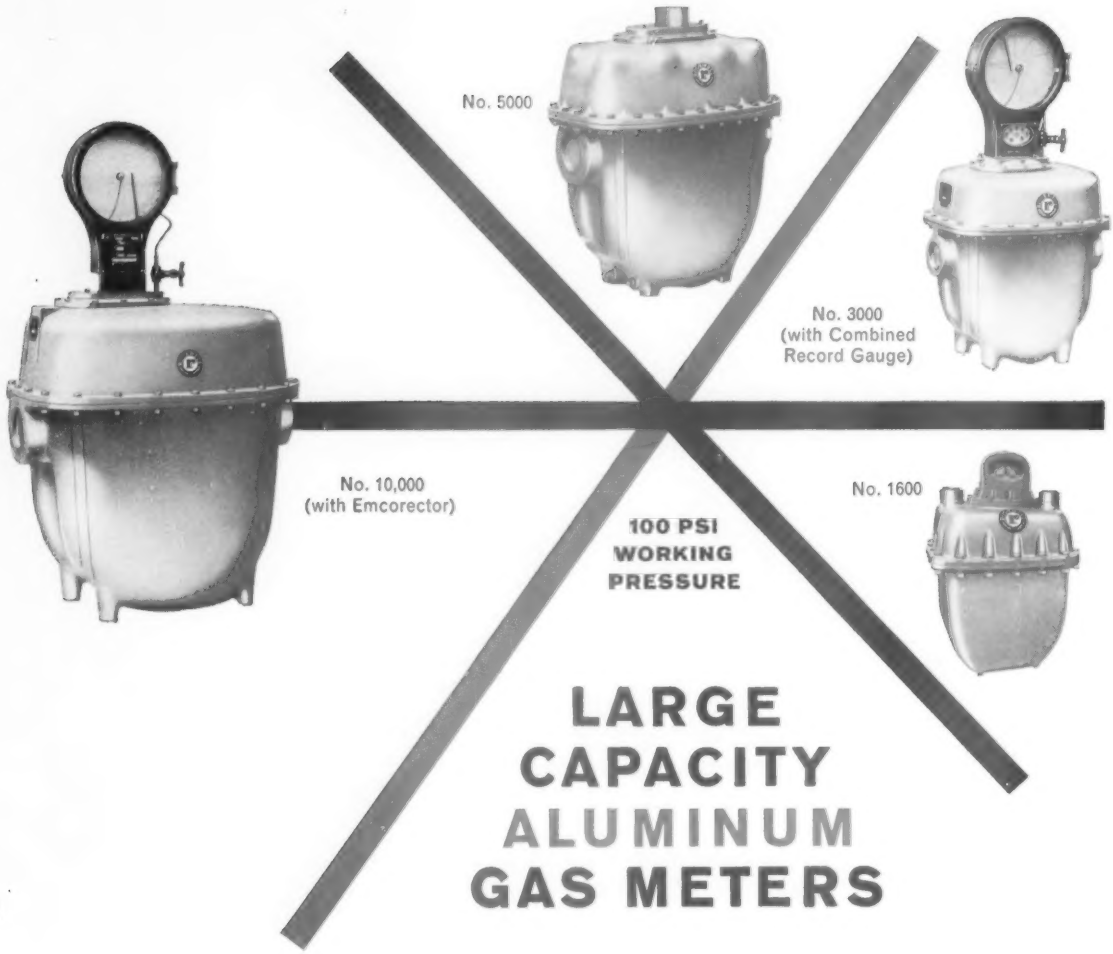
PUBLISHED WEEKLY JANUARY 23, 1961

Oil's 1961 Capital Spending:

Up 6.3% to $6.29 billion. Big gains will be in refining, petrochemicals p. 45

Pipeline Contractors Take Stock:

1961 will be another good year, but relief is needed from FPC bottleneck p. 66



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OIL AND GAS JOURNAL
Vol. 59, No. 4

Contents January 23, 1961

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TECHNOLOGY–OPERATION

SPECIAL REPORT: WHAT PIPELINE CONTRACTORS HEARD AT SAN FRANCISCO

Pipeliners Expect Good Year in 1961 66

By Paul Reed and Carl Lawrence

The new thinking expected from the Kennedy administration is expected to bring changes in FPC procedures which will speed up hearings. Better atmosphere in Washington should mean an increase in pipeline construction.

Pipeliners Caught in Severe Price Squeeze 70

By Jack S. Gray

This is true, even though reports of 40 pipeline contractors show that they built 12,323 miles of lines in 1960, representing a 20% increase over the 1959 mileage of the same firms.

Talk to Your Government and Regulatory Officials 71

By George R. Perrine

If legalistic red tape has your pipeline project tied in knots, talk to senators and regulatory officials. Industry contacts are welcomed.

Drilling-Production

How to Reduce Drilling Costs—9 77

By Preston L. Moore

If power for drilling is actually being generated at the surface, it is a needless waste of money not to put the maximum amount possible at the bit. Here's how to apply hydraulic and bit horsepower.

How to Cut Oil Treating Costs 84

By W. B. Bleakley

In the Denver basin and other areas, the shortage of gas means buying LPG for firing treaters. Here's how one producer has cut the high cost of treating in these areas.

Transfer Pump Operates from Power Takeoff 86

New Type of Iron Bacteria Found in Salt Water 89

By J. M. Sharpley

Previously believed to exist only in fresh-water systems, iron bacteria have now been isolated from salt-water source wells. This new type was found while investigating corrosive conditions in the Long Beach area.

Refining-Processing

Gas Turbines Get Overhauled in PCI's First Ethylene Turnaround 74

By J. E. Fenex, Jr., Harvey Sims, and P. M. Ableson

Largest single job in the turnaround of the 200-million-pound ethylene plant was the complete dismantling, inspection, and repair of three 13,000-hp. gas turbines.

Don't Buy Paint for Maintenance on Price Alone 81

By R. L. Gillogly

In the over-all cost of materials purchased by a company, the amount spent for paint may be insignificant; but in view of the effect of a coat of paint, its application cost, and the value of equipment it protects, the price per gallon may be multiplied a thousand times.

New Process for Low-Cost Sulfur from Sour Gas 94

By Hugh S. Pylant

A,B,C's of Regression and Correlation Analysis 97

By J. B. Willis

The methods of statistics are uniquely fitted for the task of studying complex processes, and are powerful tools in the hands of the process engineer who will learn how and when to use them. Here's a brief look at two of these techniques.

The Foreman's Page 108

Operating refinery furnaces.

the OIL AND GAS JOURNAL Newsletter

Tulsa, Okla.
Jan. 23, 1961

Crude production should outstrip demand this year:

The explanation is that the industry in 1961 probably will rebuild crude inventories which were drawn down last year to meet demand.

The Journal estimates:

...Total demand in 1961 will increase 196,000 bbl. daily.

...Inventory build-up will take 83,000 bbl. daily more.

...This required supply will be reduced 2,000 bbl. daily by a slight increase in imports, leaving 277,000 bbl. daily of the increase to be met from domestic sources.

Gas-liquids production will increase 37,000 bbl. daily in the year, leaving a 240,000-bbl. daily increase for producers of crude. That is 44,000 bbl. daily greater than the expected increase in demand (p. 60)*.

Other forecasts from:

...Chase Manhattan Bank—gain in 1961 of 3.5% for the petroleum hydrocarbons, with gas volumes increasing by 6% and oil products by 2%. Warning: Rate of refinery operations in the year will be vital if another accumulation of excessive inventories is to be avoided.

...Du Pont—Total gasoline consumption will average at 4,284,000 bbl. daily, a gain of 2.4%. Market for domestic motor gasoline is projected at 4,085,000 bbl. daily, a gain of 2.7%. This is less than the gain registered in 1960 due to an expected drop in new car sales and the impact of the compacts.

Demand for refined products in Canada is expected to take a modest 3% increase this year.

But producers hope to increase crude and gas-liquids output to around 600,000 bbl. daily, up almost 10% over 1960.

The explanation: They're counting on increased exports to Washington and the Great Lakes area. And they expect the crude imports into Ontario to stop or to be reduced.

American oil companies will boost capital spending in 1961 by 6.3%, they tell the Journal. Total is estimated at

---

*Refers to article in this issue giving more details. When no page is given, the item is a Newsletter exclusive.

$6.29 billion and is considered on the firm side.

Drilling will show the smallest gain—only 0.6% over 1960. Petrochemicals will show the sharpest spurt—up 77.2%. Refining spending will rise 27.5%, marketing 14.7%, and transportation 3% (p. 45).

▼ ▼ ▼

Foreign drilling continues at near-record levels with 848 rotary rigs in action this month. This compares with 857 at mid-1960 and 839 at the end of 1959.

The count: Latin America 432, western Europe 189, Africa 112, Asia-Pacific 60, and Middle East 55 (p. 65).

Largest hole ever drilled with a rotary rig has been completed and cased by Kerr-McGee.

The company drilled a 90-in. shaft to 721 ft. in New Mexico's Lake Ambrosia area. Shaft will serve a uranium mine.

▼ ▼ ▼

Long-awaited superdeep well in Citronelle field is now on the way down. Jett Drilling will take the 1 Citronelle unit B-31-7 to 20,000 ft. to probe deeper possibilities of the field, now classed as a major oil deposit.

Producing horizons in current wells lie between 10,870 and 11,400 ft. in formations of basal Cretaceous age. Jett aims the deep bit at the underlying Jurassic section, recent source of many new fields in East Texas, North Louisiana, and Mississippi.

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The Puget Sound area is a likely market for a part of the liquids which will be produced with natural gas for the Alberta-San Francisco gas line.

Shell, a major supplier of the line, could take part of its liquids output at the Anacortes, Wash., refinery.

Other Alberta liquids would gain access to several U. S. markets through the proposed Hudson's Bay line. It would connect with the affiliated Continental crude-pipeline system in Montana. Then through connections with Platte and other pipelines Alberta liquids could reach Wood River, Chicago, or other points east.

The Edmonton-Montreal oil pipeline project is opposed by a majority of the Canadian cabinet, according to reports coming from Ottawa.

This practically rules out any early approval of the controversial $350-million line.

Ministers favoring the line are Harkness, defense; Hamilton, agriculture; and Dinsdale, northern affairs.

Eastern ministers reportedly are wary of the pipeline on

two counts: Possible adverse political reaction in the east and doubts about its economic feasibility.

The 250-mile, 30-in. pipeline to connect newly discovered gas reserves of northern British Columbia to Westcoast Transmission system at Ft. St. John may be started early next year.

Additional reserves are being proved up by a big drilling program this winter.

▼ ▼ ▼

FPC now seems to be on a rampage against upward Btu. adjustments in gas-sales contracts. This is showing up first in the Oklahoma Panhandle area.

The story is this:

During past 2 years, FPC has issued 80 unconditioned certificates to sell gas of 1,000 Btu. at 17 cents plus 1/100 cent per M.c.f. for each additional Btu. per cubic foot. But recently as producers dedicate additional acreage under existing contracts, FPC requires the Btu. adjustment be stricken. Most producers are accepting temporaries on this basis but are refusing permanent certificates and threaten to take their case to court.

There's a rumor that FPC may call an area-pricing conference for the Oklahoma Panhandle to discuss the issue.

▼ ▼ ▼

Notes from Pipeline Contractors meeting: Look for more lines similar to the coal-slurry line now in operation. At least three similar lines are under study...TGT's Gardiner Symonds says his company wants no part of buying Transwestern stock held by Monterey...Pipeliners at the meeting contend the gas line from Texas to California via Mexico could easily be built along a U. S. route and be supplied from U. S. sources.

Industry notes: Aurora Gasoline grants 10-cent hourly wage increase for each of next 3 years to maintenance and production workers at Detroit refinery in return for "no strike" clause...Humble has sights on Michigan and Florida as most immediate targets in its marketing push into all 50 states... American Oil says it's setting up in Chicago the world's largest centralized credit-card accounting and collection operation...Texas oil operators may get their last chance Mar. 28 to pick up leases on state lands for one-eighth royalty. The state may require one-sixth royalty at future auctions... Oklahomans soon will operate under new set of field rules with a new depth-acreage formula for setting oil allowables (p. 48)...Oil vs. Coal: Petrochemicals are cutting deeply into traditional coal-chemical markets (p. 52). Oil industry leaders now give approval to a fair national fuels study (p. 54).

Market Memo

Jan. 23, 1961

The distillate market is still good, but more really cold weather soon will be needed to keep the momentum going and support current higher prices.

Price structure on the East Coast is given strength by threat of tug workers strike in New York harbor, the higher Gulf Coast price levels, and a firm tanker market.

Gulf Coast distillate prices advanced one-fourth cent from 8.75 to 9 cents per gallon following a half-cent boost on the East Coast a week earlier.

Seven cargoes of distillates plus some barge lots were sold on the Gulf during the price changes, some of it undoubtedly going at the 9-cent level. This immediately put supply on the Gulf into tight position. Word is that the market is cleaned up into February with some inquiries for January liftings not covered at 9 cents.

Gulf Coast refiners apparently have decided to sell off sharply, counting on refinery runs to meet their own needs.

Distillates on the Mississippi River and in the Mid-Continent are steady. River marketers are restricted by the high Gulf Coast prices and their inability to reach far up-river points at this season.

High gasoline inventories have begun to worry the trade.

Sinclair's P. C. Spencer warns of "price demoralization" if stocks keep building.

Two factors are favoring gasoline now:

Big stocks are in the hands of large suppliers who are able to hold them.

Recent sales of distillates on the Gulf by independents have cleared out clean storage and give these refiners places to store excess gasoline.

East Coast gasoline market still is considered in good shape for the season in spite of spotty weakness such as exists in Portland, Me. Dealer tankwagon prices on regular there dropped 0.9 of a cent to 13.9 cents a gallon.

Gasoline postings on the Gulf still are 11.25 cents for 92-octane with no sales to confirm this level. Feeling is that bids at one-half cent off would get a buyer several cargoes, but none is buying. One independent reportedly turned down bid for sizeable shipment at three-fourths of a cent off for up-river movement over a 3 months' period.

A post-Suez high for a clean tanker charter has been set on the U. S. Gulf-North of Cape Hatteras run.

A T-2 type tanker was chartered for loading at Texas City the end of this month for ATRS plus 42½%, or just over $4 per ton. Destination is New York harbor.

Good Wells Make Good News

A Report on Some Unusually Successful Recent Frac Jobs

January 23, 1961

Here are four recent examples showing how Dowell fracturing services have helped operators increase oil and gas production and profits.

- **Butler County, Kansas** (Waterflood Producer) Production from this Kansas City lime well had declined to 4 bopd and 30 bwpd. Dowell engineered a treatment using the Frac Guide*. 5000 gallons of acid-oil emulsion carried 10,000 pounds of 20-40 mesh sand into the formation at 12 bpm. 140 days after treatment, production was 81 bopd and 106 bwpd.

- **Panola County, East Texas** (Old Gas Well) Gas delivery from this well into the 300-psi line had declined to 200 mcfd. The well had been producing from eight perforated intervals between 6068 and 6434 feet in the Travis Peak formation. The total perforated pay was 111 feet -- 70 of which looked good on logs. Dowell engineers fractured the well using 100,000 gallons of gelled water and 70,000 pounds of 20-40 mesh sand -- 1000 pounds sand per foot of good pay. As each interval was fractured, perforation ball sealers were injected to divert fracturing fluids to another zone. Injection rate averaged 24 bpm at pressures ranging from 2500 to 4000 psi. After treatment, delivery to line was 1200 mcfd, a net increase of 1000 mcfd. Payout was fast -- approximately 1½ months.

- **Jones County, Northwest Texas** (New Oil Well) This tubingless completion was made into the Canyon sand through five sets of perforations between 3864 and 4039 feet. Initial test was almost two boph but operator wanted to stimulate so top allowable would be assured. Dowell engineered a treatment using the Frac Guide. 40,000 gallons lease oil with FLA* (Fluid Loss Additive) and 80,000 pounds sand were injected down 2½-inch casing at 12 bpm and 3400 psi. After treatment, well potentialed 1560 bopd -- a 30-fold increase.

- **San Juan County, New Mexico** (New Gas Well) This development well was drilled into the Dakota sand between 6698 and 6774 feet. Permeability was so poorly developed, compared to other wells in the area, that abandonment was considered. However, operator decided to complete the well, using Abrasijet* -- abrasive jetting service -- and fracturing. With Abrasijet, Dowell cut five notches into formation at 6698, 6704, 6756, 6768 and 6774 feet. About 20,000 pounds of sand was used. Dowell then fractured using water to carry 30,000 pounds of sand at about 35 bpm. Well potentialed 2500 mcfd -- similar to other wells in the field. Operator believes $4500 treatment made an economic producer out of what would otherwise have been a dry hole.

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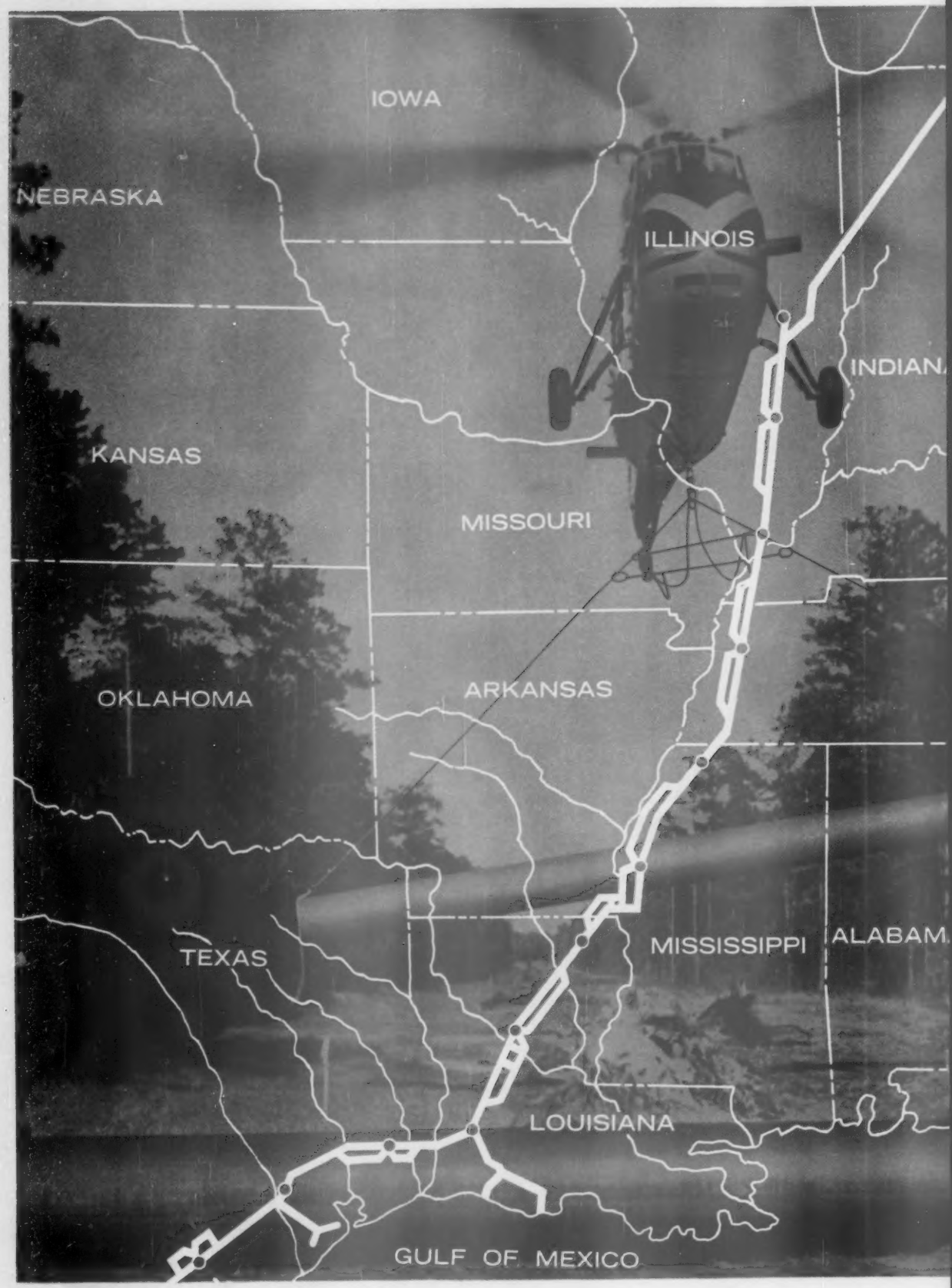
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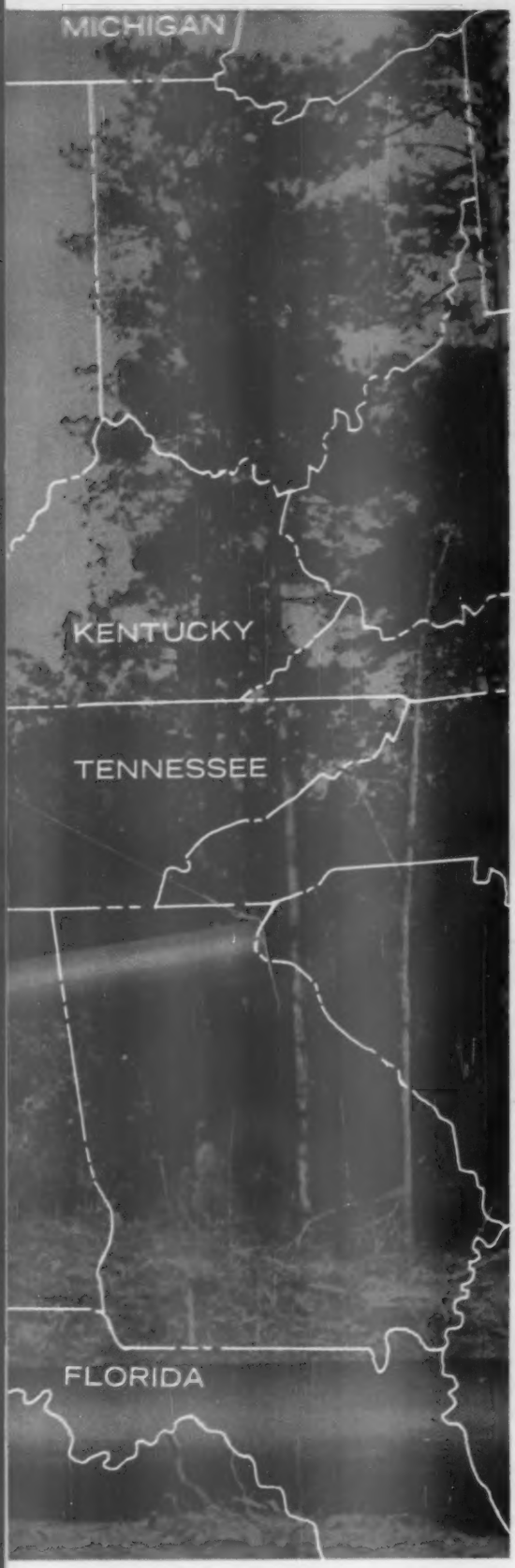

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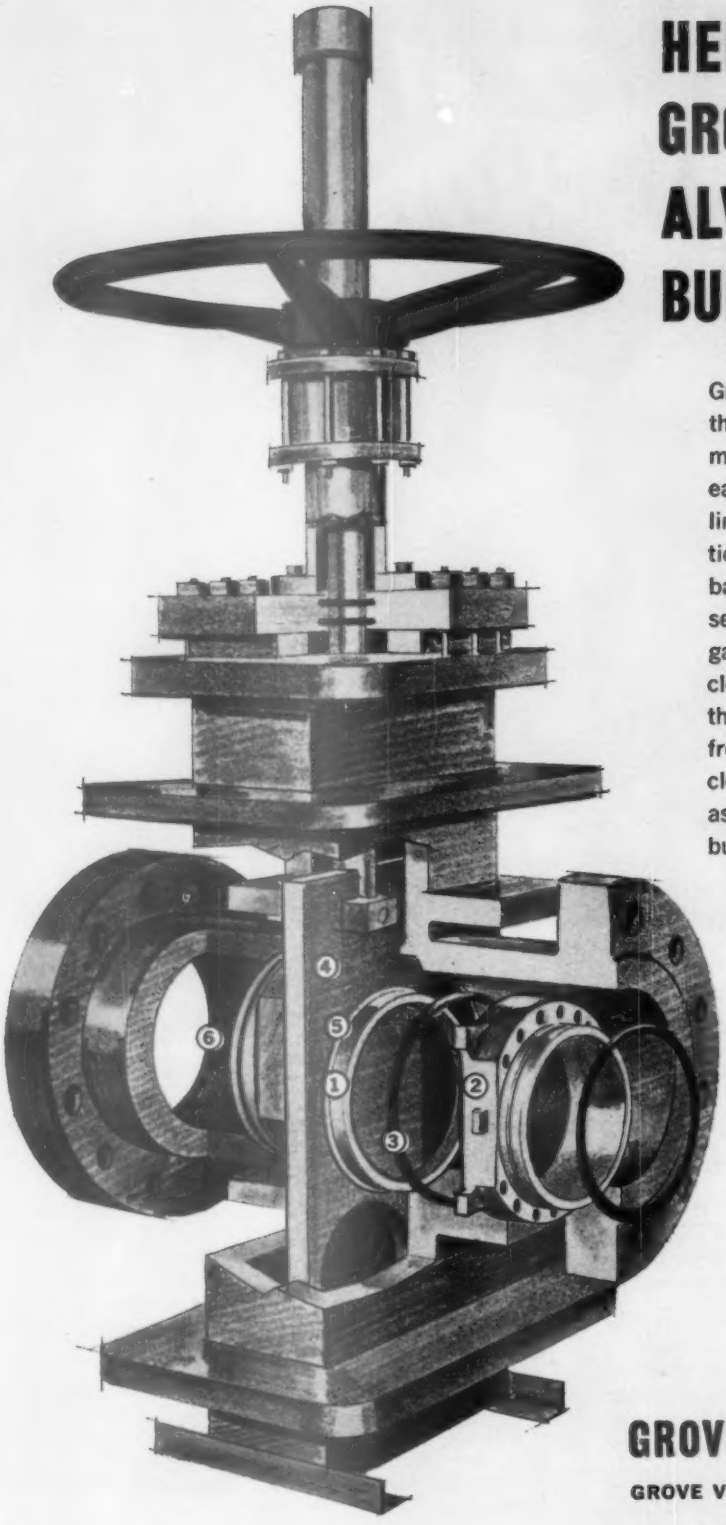

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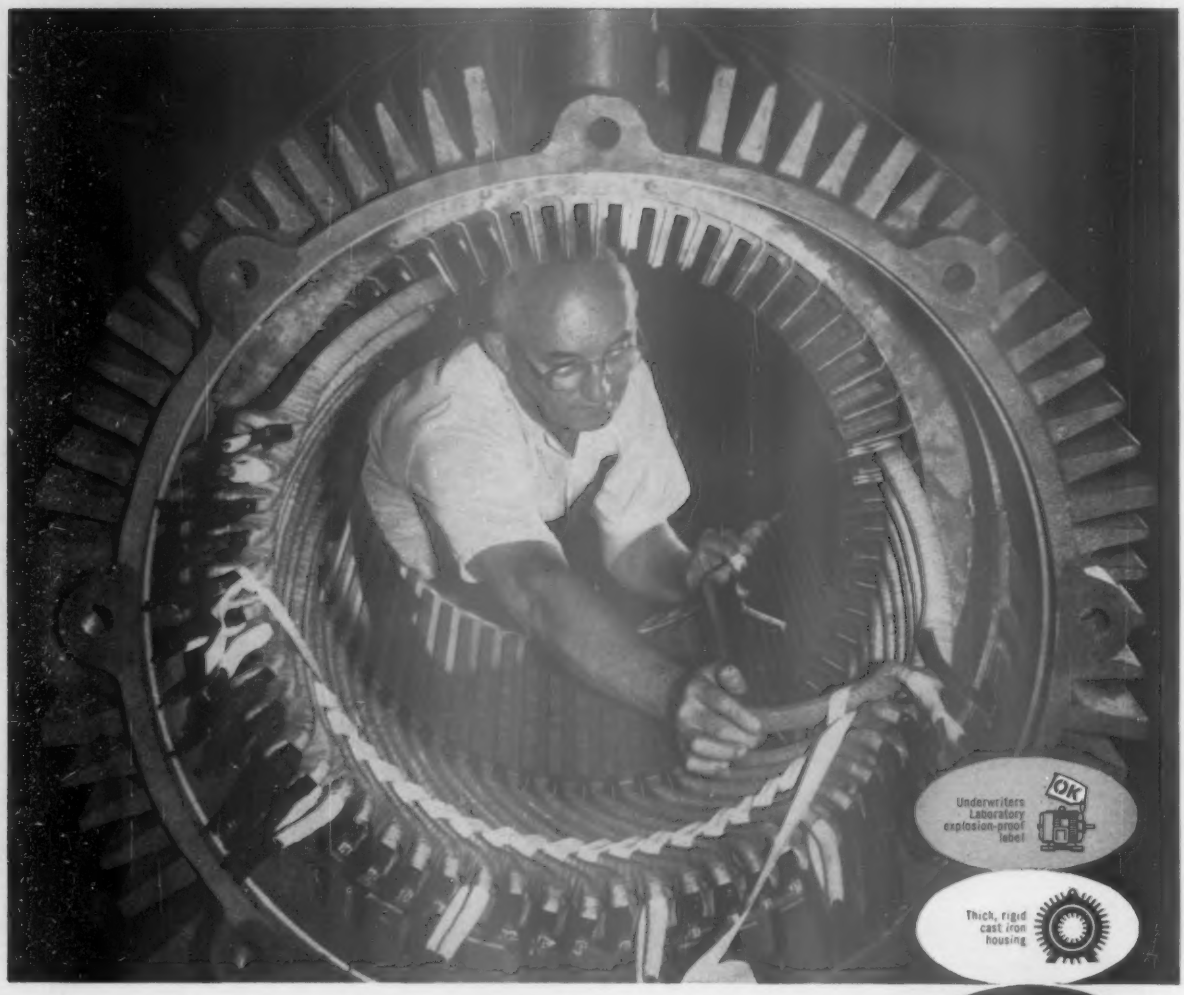

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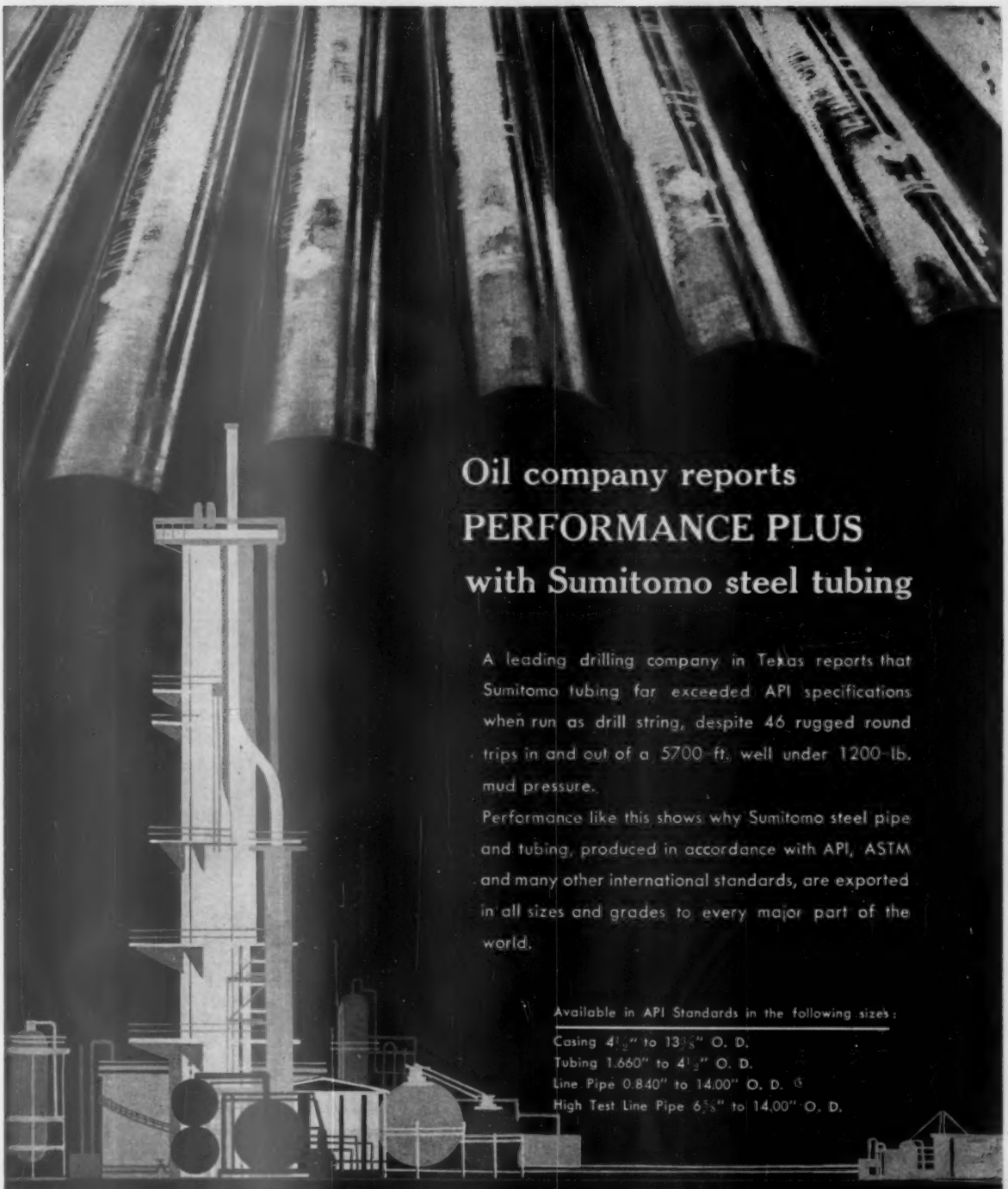

Oil company reports PERFORMANCE PLUS with Sumitomo steel tubing

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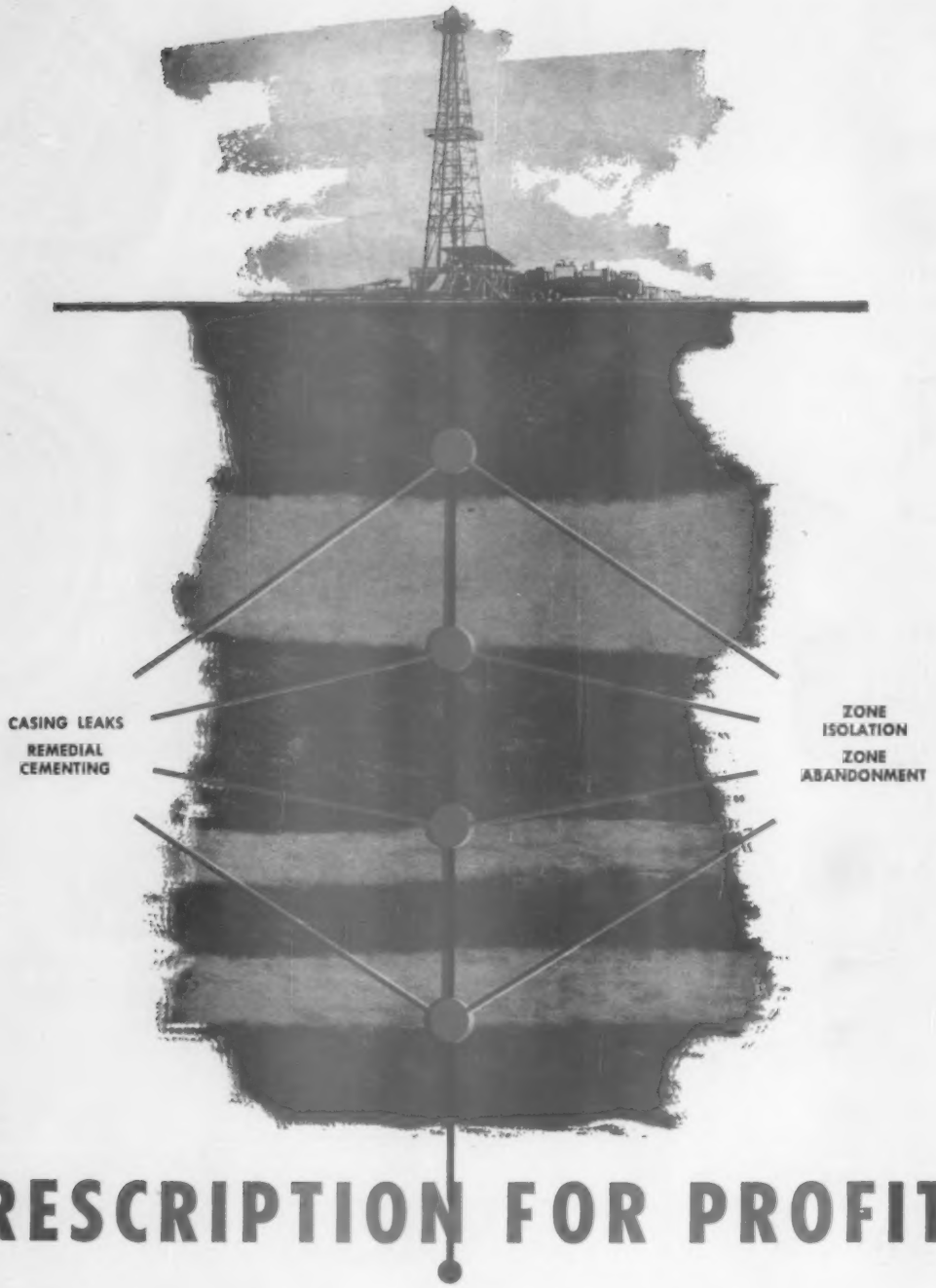

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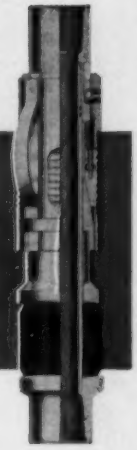
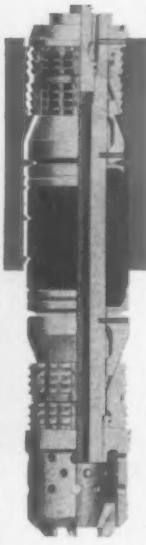
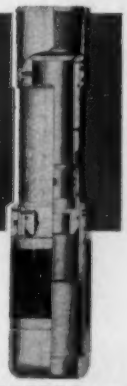


R-3 TREATING-PRODUCTION PACKER . . . is an economical, full opening retrievable tool. Its design eliminates the need for a tubing hold down since the tool itself is self-anchoring against pressure from below the packer. Designed for easy, inexpensive maintenance, the tool may be set and reset on one trip in the hole. Several sizes of R-3 Packers are available through your nearby Halliburton Representative.



WIRE LINE BRIDGE PLUG . . . is another dependable casing bridging plug designed for use in well applications similar to those of the "DM" and "DC" Squeeze Packer. This tool is drillable, shorter and more compact with a relatively soft center packer rubber supported at each end by two hard rubbers and expanding metal shoes which form an effective metal bridge between mandrel and casing I.D. when set. Even with the built-in junk pusher, there is less material to drill out than with many other bridge plugs.

WIRE LINE HYDRAULIC SETTING TOOL . . . can be used to set a "DM" and "DC" Squeeze Packer or a Wire Line Bridge Plug from a sand or drilling line. It may be run in a well with or without fluid since the tool carries its own operating fluid. A few short upward strokes with the wire line operates the hydraulic pump inside the tool to build up pressure adequate to shear the pins, set the slips, and expand the packer rubbers and part the tension sleeve. Setting tool is then free for removal from well before service job begins.



FULL-FLOW PACKER SHOE . . . acts as a regular Formation Packer Shoe – running in on the bottom of the casing string, expanding to seal off the hole, and opening to allow cement displacement through ports in the tool. In addition, after cement is displaced, continued pumping against the closing plug closes the cementing ports, frees the internal parts in the shoe and causes them to discharge out the shoe into open hole below. No drilling out is required.

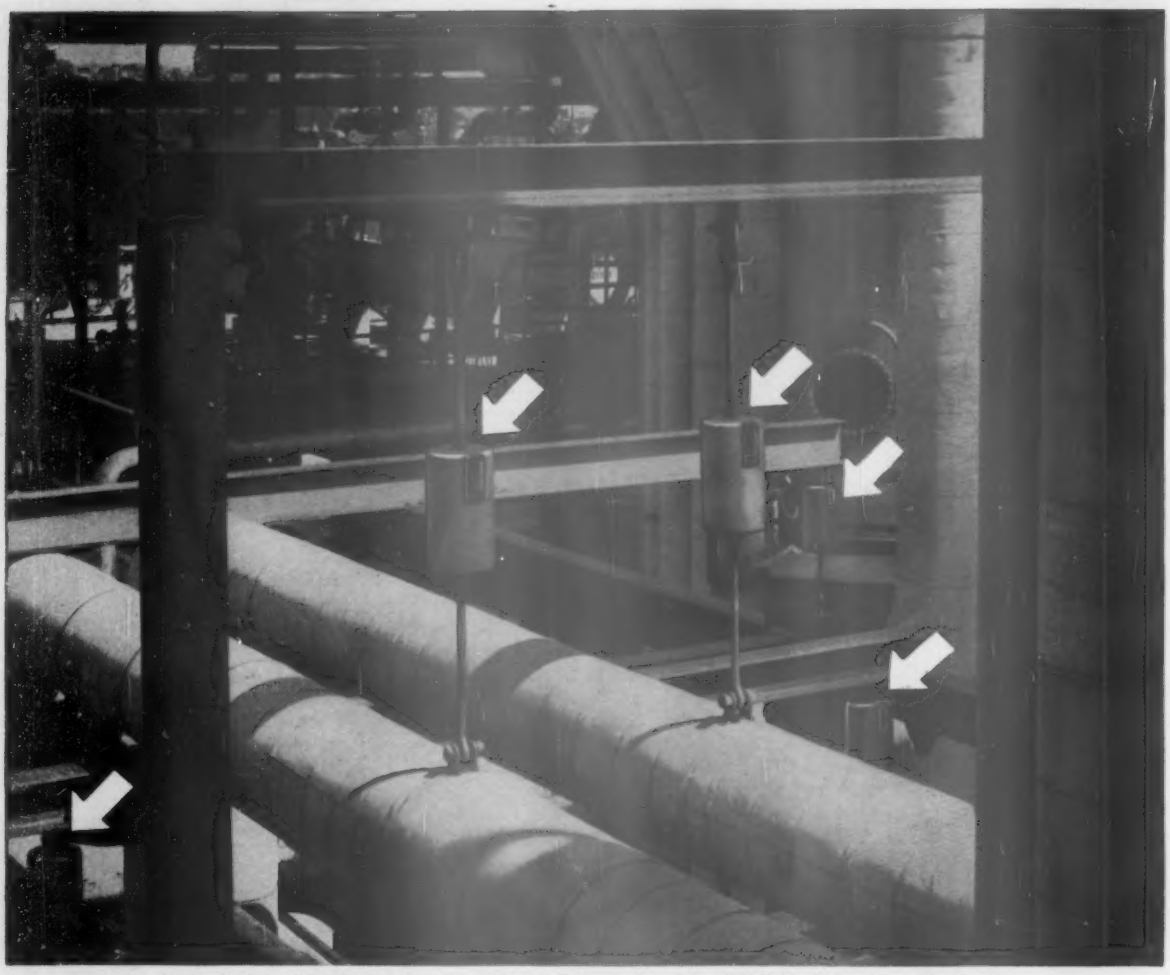
Call your nearby Halliburton Representative now, for more details on these job-proven tools.

CEMENTING SERVICES

275 SERVICE CENTERS . . . JUST MINUTES AWAY FROM YOUR WELL

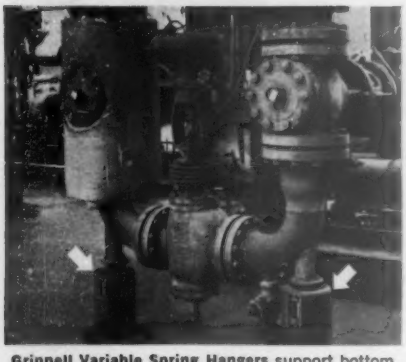
Halliburton

COMPANY • DUNCAN, OKLAHOMA



Heater feed line (r.) and return line (l.) at Sinclair Refinery show Grinnell Variable Spring Hangers at work.

Grinnell Hangers support high-temperature pipe lines at Sinclair Refinery



Grinnell Variable Spring Hangers support bottom lines on vacuum still operating at 750°F.

Hot news: Grinnell variable Spring Hangers support pipe lines at Sinclair Refining Company's Marcus Hook, Pa. plant, that operate at temperatures *above 500°F.* Yet these flexible hangers easily accommodate thermal movement in the pipe lines!

Where reactive forces at terminal points must be kept within specified limits, *Grinnell Constant Support Hangers* are recommended. Where pipe lines are subject to vertical movement and restrictive conditions do not require the use of a constant support type, *Grinnell Variable Spring Hangers* are recommended. Where abnormal horizontal movement or vibration in pipe lines must be prevented, *Grinnell Sway Braces* are recommended.

Grinnell maintains a staff of trained technicians . . . provides highly skilled advice and assistance right from the design stage . . . offers experienced field engineering service. Call Grinnell Company, 277 West Exchange Street, Providence 1, R. I.

GRINNELL AMERICA'S #1 SUPPLIER OF PIPE HANGERS AND SUPPORTS

Pipe Fittings, Valves, Pipe Hangers, Prefabricated Piping, Unit Heaters and Piping Specialties • Branch Warehouses and Distributors from Coast to Coast

Miles of Mid-America . . .

SUPPLIED BY SOUTHWESTERN

Southwestern produced a good portion of the Lightwall pipe used in gathering lines on the 2300-mile Mid-America Pipeline delivering LPG from West Texas-New Mexico to the upper Midwest.

Sturdy Southwestern Lightwall Line Pipe is recommended for many different pipeline applications . . . helping to solve problems in transporting hydrocarbons and light petroleum fractions over and through all types of terrain, doing the work of heavier wall pipe at substantial savings in costs.

TAKE A LOOK AT LIGHTWALL by SOUTHWESTERN . . . your PROFIT PIPE

Available in a wide range of sizes for oilfield application.

Write for new folder covering complete details

SAVE WITH SOUTHWESTERN INTEGRAL JOINT TUBING

Southwestern Tubing can save up to 30% on dual completion well costs over the cost of non-upset. It is expressly designed for more economical Slim Hole and Multiple completions.

Check these outstanding features:

1. Recessed box for easier stabbing and greater resistance to hoop stress induced by make-up.
2. Laboratory pull tests prove joint efficiency to be much greater than theoretical (calc.).
3. Make and break tests far in excess of normal well servicing indicate excellent gall resistance.
4. Multiple hydrostatic, shock and crush tests assure completely sound welds and true dimensional wall thickness.
5. Interchangeable with standard 10Rd. API non-upset tubing.
6. Manufactured to conform to applicable parts of API 5A standards.

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SOUTHWESTERN PIPE, INC.

P. O. Box 2002 Houston 1, Texas Phone CApitol 4-0631

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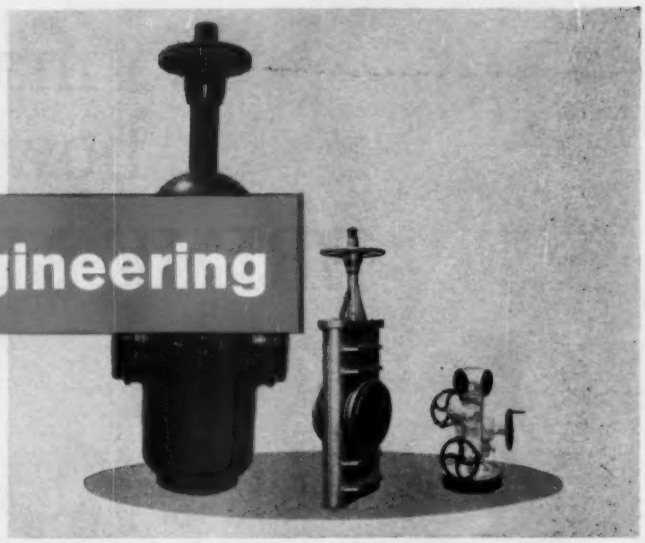
NOW

TOTAL Valve Engineering

NEW W-K-M COMPUTER PREDICTS PERFORMANCE



Left to right above, W-K-M's new: *Safe-T-Seal* Gate Valve (ASA); Pressure Sealing Gate Valve (ASA); Cross-type Triple Gate Valve (API).

Unique strain gauge analyzer pre-solves your valve problems

In *seconds* it gives answers that used to take *days*. This unusual digital logging computer developed to W-K-M engineering specifications finds out what will happen to a valve under every conceivable service stress.

The W-K-M computer measures strain, applies corrections for temperature, test material and gauge factors, and prints the results of its stress calculations. It can analyze 40 areas of a valve in less than 40 seconds!

Advanced research is an important part of TOTAL Valve Engineering—W-K-M's unique dedication to *all* phases of valve technology. Another reason why W-K-M Valves perform better, last longer . . . on the world's toughest jobs.

W-K-M

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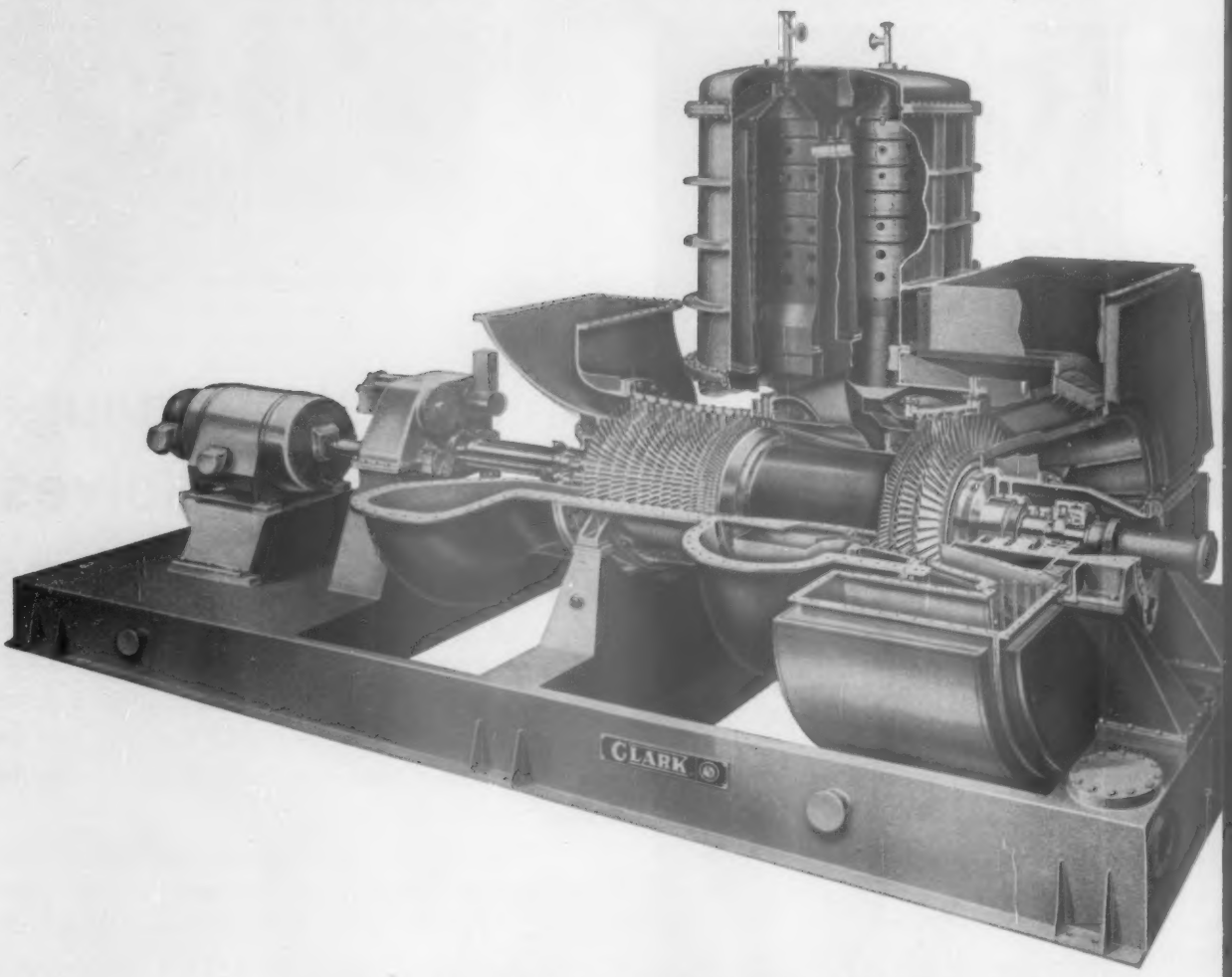
No matter how you gauge PRIME MOVER COST...



CLARK BROS. CO., OLEAN, N.Y.

CLARK

DRESSER INDUSTRIES INC.
OIL • GAS • CHEMICAL
ELECTRONIC • INDUSTRIAL

ENGINES • GAS TURBINES • COMPRESSORS

the CLARK 300 series of GAS TURBINES measures up fully to your needs

Name the norm . . . capital investment, floor space, installation or operating labor, general reliability, maintenance or all combined. Whatever you use to determine *real* prime mover cost, Clark heavy duty industrial gas turbines provide the most economical answer to your requirements. As an example of how these advantages work for you let us examine the latest addition to the Clark 300 series of turbines, the Model 305-S.

CONSIDER INITIAL INVESTMENT—This single-shaft open cycle machine is simplicity itself. With the axial compressor and three stage turbine mounted on the same shaft, parts . . . *and cost* are cut to a minimum.

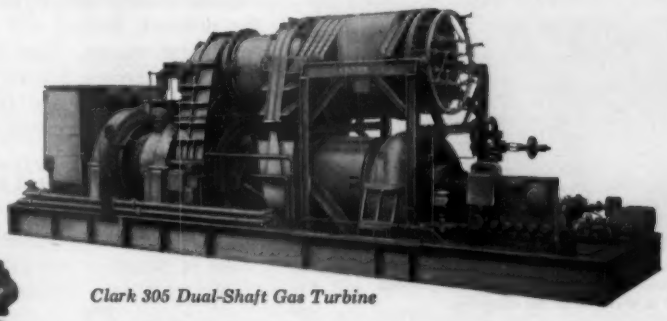
FIELD PROVED RELIABILITY—Important components such as compressor and turbine blading are based on proved designs which have operated for thousands of hours in Clark Dual-Shaft Gas Turbines. Turbine inlet temperature is held under 1400° F to ensure extra long life and to provide a substantial margin of operating safety. The turbine is completely air cooled and suitable for operation in arid country. Pressurized air is bled off the axial compressor to cool turbine blade roots and other high temperature components. In addition, cool air envelopes between inner and outer skin surfaces reduce heat loss and minimize heat radiation.

FLOOR SPACE INSTALLATION AND MAINTENANCE—The Clark 305-S is so compact it is mounted on a skid only 26 feet long. The combustion chamber with two parallel burners is placed over the rotor between compressor and turbine. You save on floor space, housing, transportation to the site, foundation and installation expense. Both the single and dual-shaft Clark gas turbine designs have provisions for easy access to blading, bearings and seals for inspection or maintenance.

VERSATILE TOO—Clark Series 300 Gas Turbines in the 8000-10,000 horsepower class provide the inherent flexibility to match the application. The dual-shaft models are excellent drivers for pumps or compressors on liquid or gas transmission lines, for marine propulsion, compressor drivers in repressuring or process plants and other uses requiring broad speed and loading flexibility. For applications that do not require the wide range flexibility of the dual-shaft machine such as base load or peaking turbogenerators the single-shaft units are ideal. Both designs burn either liquid or gaseous fuels.

Your Clark representative will gladly give you all of the cost saving details on Clark Gas Turbines. Consult him or write us direct. CLARK BROS. CO., OLEAN, NEW YORK.

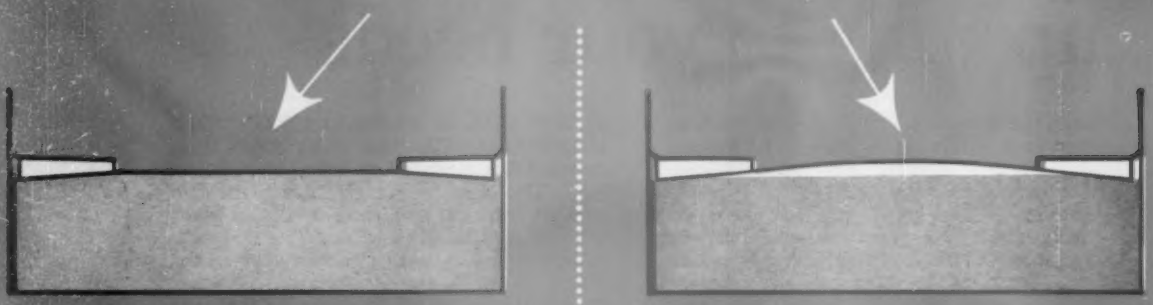
Clark 305-S Single-Shaft Gas Turbine



Clark 305 Dual-Shaft Gas Turbine

Efficient VAPOR TRAPPING...

a "built-in" feature of HORTON® FLOATING ROOFS for over 35 years



The Horton Pontoon Floating Roof has an annular pontoon around the outer edge of the roof and a deck of single thickness at the center. The pontoon provides effective air space insulation for a large area of the liquid surface. Under normal conditions, the underside of the Horton Pontoon Floating Roof is in contact with the product in the tank.

Increased temperatures may cause the product in the tank to boil. Should this occur, the vapors are trapped beneath the center section of the roof due to the upward slope of the pontoon bottom and the flexibility of the center deck. The trapped vapors lift the center of the deck and provide an insulating vapor space to reduce further boiling.

130,000-bbl. tank equipped with a Horton Pontoon Floating Roof serves the marine loading terminal of a West Coast oil company.

Prime reason for equipping flat-bottom storage tanks with floating roofs is to prevent the loss of valuable volatiles through evaporation. Efficient vapor trapping is essential for the more volatile stocks.

The sun's rays striking the single deck portion of a floating roof heats the deck and the product beneath. Boiling often occurs, causing vaporization. Unless these vapors are retained by the deck rising from the product, boiling will continue. Horton Pontoon Floating Roofs trap these vapors. They form an insulating space during the heat of the day retarding further boiling. As cooler temperatures occur, the vapors recondense and the deck returns to the liquid surface. The result: *Maximum protection against costly evaporation loss and deterioration of product.*

Vapor trapping is just one of the many money-saving features that have made Horton Floating Roofs your best buy for over 35 years. Write today for the complete story.

CHICAGO BRIDGE & IRON COMPANY

332 SOUTH MICHIGAN AVENUE
CHICAGO 4, ILLINOIS

OFFICES AND SUBSIDIARIES IN PRINCIPAL CITIES THROUGHOUT THE WORLD

Why the major seller of new equipment is your logical supplier of used equipment

When you are in the market for a used car, chances are you can get your widest choice and best value from the dealer who sells the most new cars.

This is also true in the oil country supply business. National Supply, as the leading supplier of drilling and production equipment and tubular products, usually can offer you a choice of used equipment capable of giving excellent service.

Used equipment items generally available through your National Supply store include complete rigs and auxiliary equipment—everything to round out your drilling equipment needs. National Supply also is the place to look for used pumping units and accessories, and tubular goods—drill pipe, casing and tubing.

No matter what your requirements—new or used equipment, repair parts, general supplies, or just sound, technical advice—you'll find that the National Supply store is your most reliable, economical source. There are 118 of these stores located strategically to serve you. Next time you buy, see National Supply.

See next pages for announcement of new J-50 triplex pump

National Supply announces

Three J-50 triplex pumps are operating in this water flood installation near Wichita Falls, Texas. Large plungers available for the new National Supply J-50 give it the capacity to produce a higher volume than any comparable triplex pump.

NEW J-50 TRIPLEX PUMP

for Water Flooding · Power Oil Service Salt Water Disposal

A new horizontal triplex pump, the J-50, is announced by National Supply for many applications such as water flooding, salt water disposal and power oil service. The pump is rated at 50 input horsepower.

The new J-50 triplex pump offers low initial cost, plus a proven ruggedness and smooth operation that will minimize your downtime.

Some of the important advantages are:

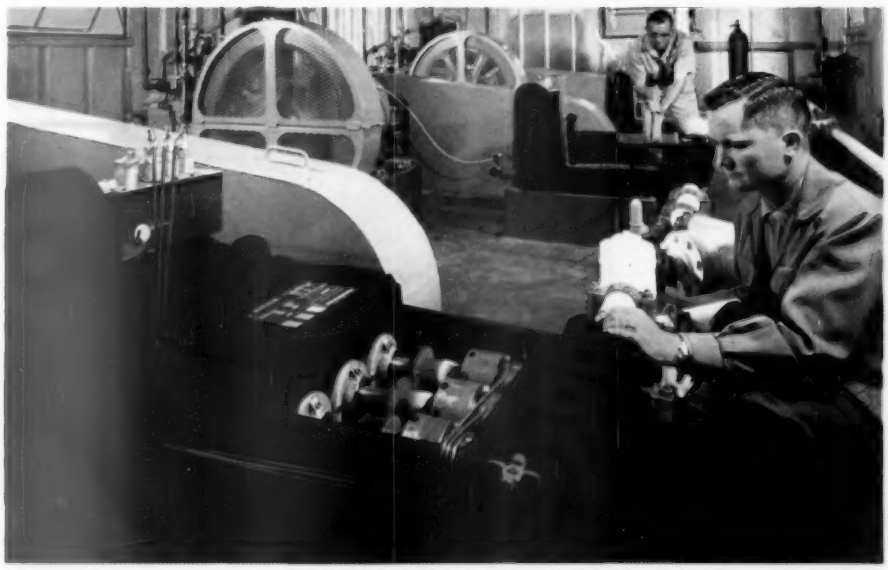
BUILT-IN SUCTION DAMPENER. The diaphragm-type suction dampener runs the full length of the fluid end, directly beneath the suction valves, to provide optimum dampening effect. This prevents harmful surges from developing in the suction piping.

LIGHTWEIGHT ALUMINUM ALLOY CONNECTING RODS. They permit operation at higher pump speeds, with greatly reduced inertial loading. Connecting rods form their own bearing surface, give long, trouble-free service.

DOUBLE EXTENSION CRANKSHAFT. Made of forged steel, it permits a direct or a V-belt drive connection to be made without reversing the crankshaft. Double extension enables you to connect auxiliary drives, such as chemical, sump or charging pumps.

SPECIAL FLUID END FOR POWER OIL SERVICE. The J-50 can be equipped with a fluid end built especially for power oil service. Important features are the quick change liners and plungers. Large plungers, for high volume, can be used when the hydraulic down-well pump is to be run into the hole. The large plungers can then be replaced quickly with smaller plungers for high production pressures. Fluid ends can be furnished with a full flow, full opening, ball-and-seat valve arrangement which eliminates restrictions beneath the ball.

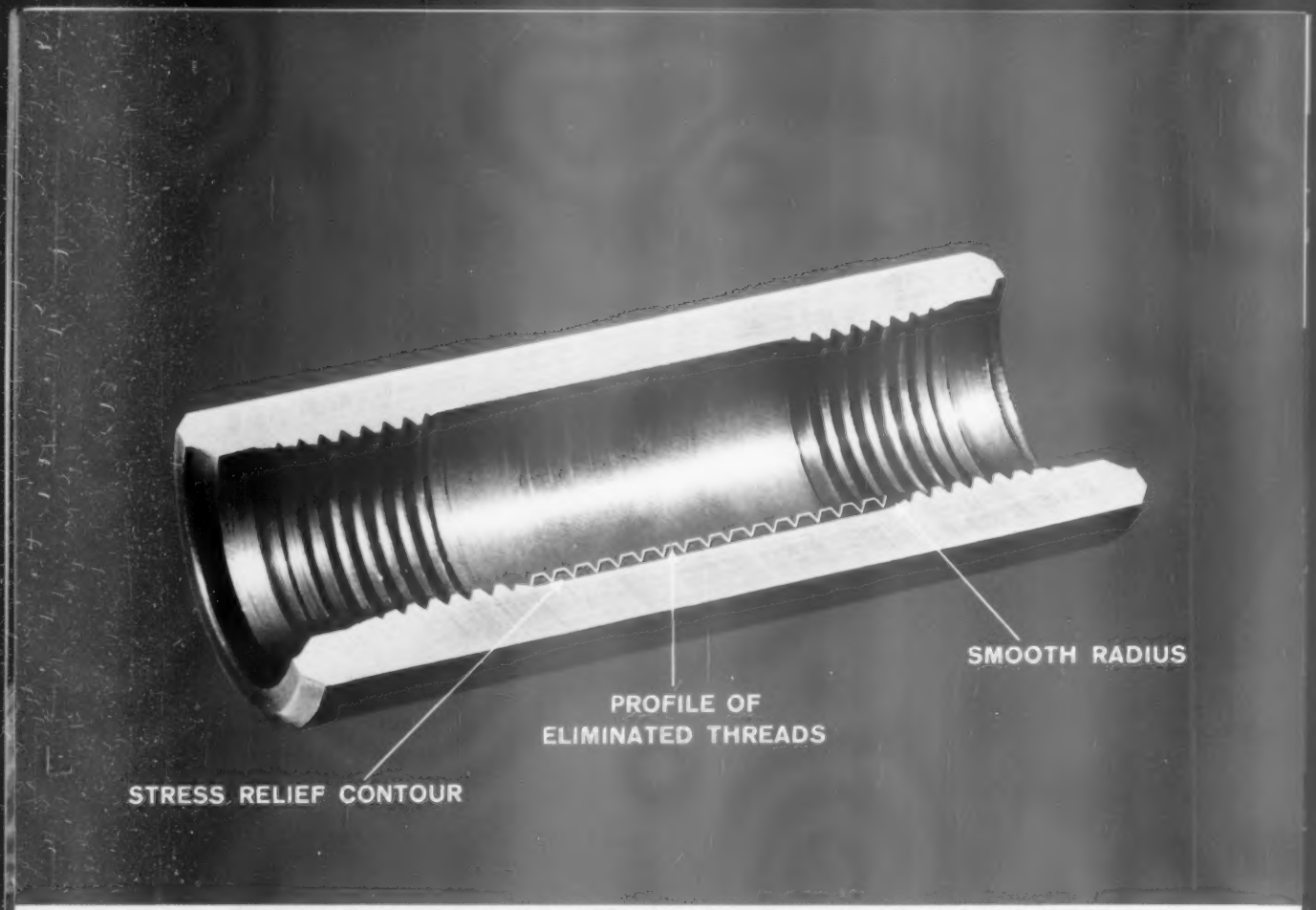
The National J-50 pump is now available in three models: the J-50 L and J-50 M for low and medium pressures in corrosive and noncorrosive service, and the J-50 PO for power oil service. Literature on this versatile new pump is yours for the asking. Write today to National Supply Division, Armco Steel Corporation, 2 Gateway Center, Pittsburgh 22, Pa.



The J-50 has an integral suction pulsation dampener extending the full length of the fluid end, directly below the suction valves for maximum efficiency. Performance and maintenance features include all those of the popular National J-125 triplex pump.

Steel

Steel's Symbol of strength, long life, and economy



This drawing illustrates how new National RC sucker rod couplings are strengthened through elimination of unused threads. Ask your National Supply representative for details.

Now! High-strength, stress-relieved couplings to improve performance of high strength sucker rods

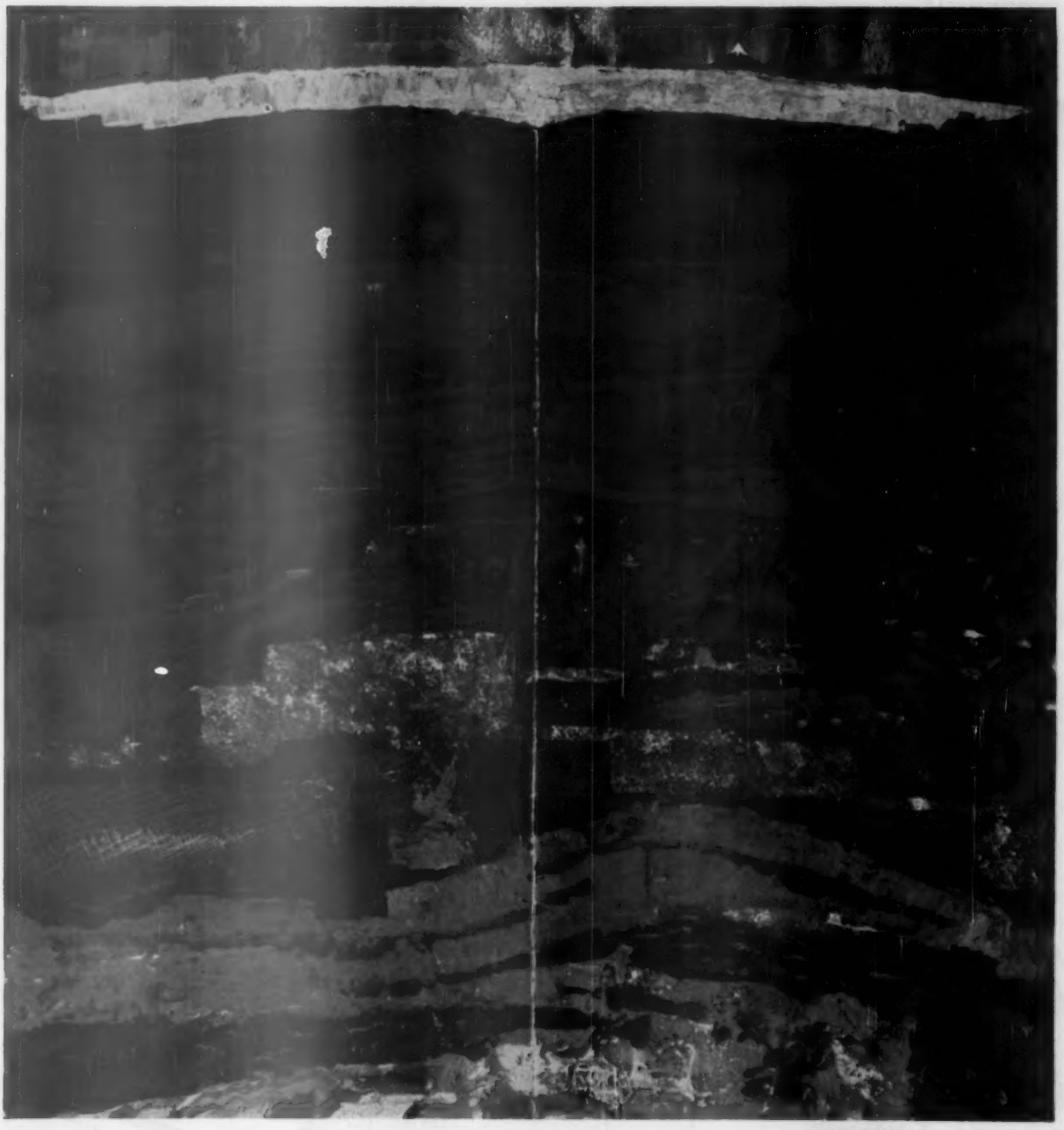
High-strength, stress-relieved sucker rod couplings designed to match the strength and performance of high-strength rods are now available from National Supply.

The design of the new coupling eliminates unused threads that formerly ran through the center of the coupling. This eliminates danger of premature failure from stress concentration at the roots of unsupported threads. The new National RC coupling has a smooth finish in this central area which blends into the last engaged threads, thus increasing fatigue strength.

Tensile strength has been increased to 130,000 psi by heat treatment. National RC couplings are available in four sucker rod sizes—⅝, ¾, ⅞ and 1 inch—and will be standard on National Grades 45, 85 and 92 sucker rods.

Get complete information on new National RC couplings by writing to National Supply Division, Armco Steel Corporation, 2 Gateway Center, Pittsburgh 22, Pennsylvania.

ARMCO National Supply Division



For wells that haven't yet been drilled

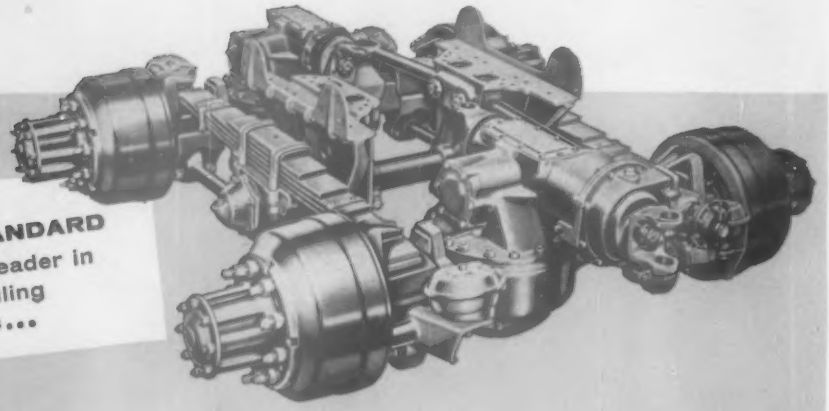
The well hasn't yet been drilled that Timken® seamless oil well tubing can't handle. Regardless of minimum yield strength required, whether it be 80,000—100,000—120,000 psi or higher, the range from minimum to maximum won't exceed 20,000 psi, and that's important if stress corrosion cracking is a possibility.

Timken Company experts have been heat-treating seamless tubing to exacting requirements for more than 30 years. Why not bring your oil well tubing or pressure tube problems to our metallurgists? Send for your free copy of the informative booklet, "Timken Oil and Gas Well Tubing". Write: The Timken Roller Bearing Company, Steel and Tube Division., Canton 6, Ohio. Cable: "TIMROSCO".

Makers of Tapered Roller Bearings, Fine Alloy Steel and Removable Rock Bits.

TIMKEN®
***Fine Alloy* STEEL**

TIMKEN ALLOY STEEL AND SEAMLESS STEEL TUBING ARE AVAILABLE FROM STEEL SERVICE CENTERS IN 44 CITIES IN THE UNITED STATES



ROCKWELL-STANDARD
Acknowledged Leader in
Rugged Hauling
Operations...

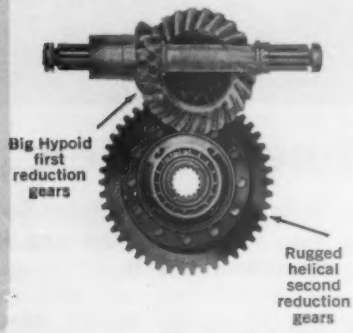
Here's why Timken-Detroit®

DOUBLE-REDUCTION TANDEMS LEAD IN TOP PERFORMANCE—LONG LIFE!

Timken-Detroit Heavy-Duty Tandems with Hypoid Helical Double-Reduction Gears are the big favorites for top performance and long life.
Here are some of the reasons why:

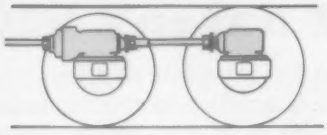
Rugged Hypoid-Helical Double-Reduction Gearing!

Balanced gearing—with two full-sized gear sets working in series to take an equal share of the load—provides a stronger power train with balanced gear set loadings and the widest range of ratios.



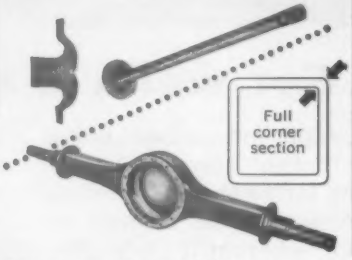
Driver Controlled Interaxle Differential!

Allows differential action between the axles to compensate for worn or mismatched tires. Both axles do equal amounts of work . . . can be disengaged at any speed, giving positive through drive when better traction is needed. *Straight-Line Through Drive* eliminates prop shaft angularity . . . increases bearing and gear life, reduces maintenance.



"Torsion-Flow" Axle Shafts and Hot-Forged Housings!

More splines, Torsion-Flow forging, and patented heat-treating processes make Rockwell-Standard shafts the toughest in the industry. Housings are hot-forged from high carbon steel, and are rectangular shaped with full strength corners for greatest strength with minimum weight.



Timken-Detroit Double-Reduction Tandems come in a wide range of capacities—6 models from 34,000 to 65,000 pounds.

Another Product of...

ROCKWELL-STANDARD CORPORATION
Transmission and Axle Division, Detroit 32, Michigan

Why, indeed? As long as you're in a hydrogen area, there's just as much danger of explosion with one piece of equipment as there is with the other.

And the same goes for acetylene areas, too. *And* for all other pieces of electrical equipment in such an area . . . fixture hangers, seals, flexible couplings, junctions, push button stations.

Crouse-Hinds is the only single source for complete systems of UL-listed explosion-proof electrical equipment, no matter what the National Electrical Code Class or Group.

Crouse-Hinds is also your prime source for expert assistance in choosing and applying equipment for hazardous areas. A Crouse-Hinds Field Engineer is always available to help you plan complete protection in flammable atmospheres of gases, vapors or dusts.

Call your Crouse-Hinds Distributor while you're still in the planning stage of building or remodeling. *That's* the time he can really save you money!

**National Electrical Code designations*

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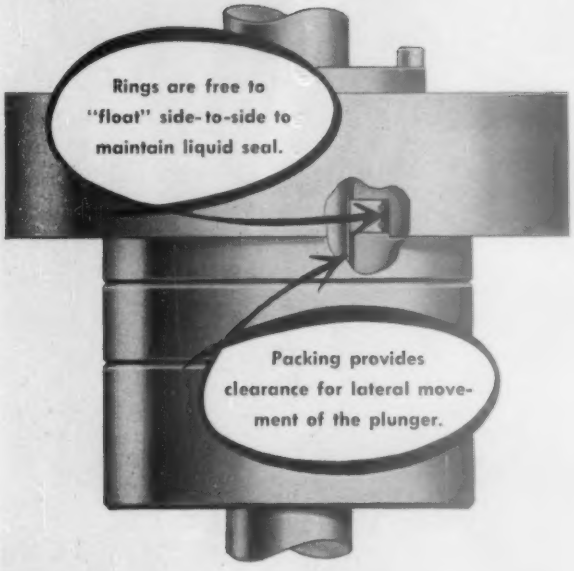
ENGINEERING

NEWS YOU CAN USE ABOUT ENGINE AND COMPRESSOR PERFORMANCE

THIS LIQUID-PUMP PACKING ACTUALLY FLOATS TO ELIMINATE COSTLY LEAKAGE PROBLEMS

Cook's special full-floating, self-adjusting packing boosts performance, reduces downtime of high-pressure plunger pumps


Rings are free to "float" side-to-side to maintain liquid seal.
Packing provides clearance for lateral movement of the plunger.

Plungers of all liquid pumps tend to "run out of true." As a result, conventional packings must make room for this lateral movement with a clearance around the plunger. Thus, a path is soon formed and excessive leakage occurs. This leakage can be reduced by adjustment but soon starts again.

To eliminate this annoying and expensive packing problem, Cook has designed a special liquid-pump packing which has proved itself in a number of varied field applications. This Cook packing actually *floats with the movement of the plunger*. It doesn't have to make room for the "run-out" of the plunger—it simply moves with it!

Cook packings are now successfully handling all types of liquids—oil, water, chemicals, brine, etc.—under many special operating conditions. These self-adjusting packings now make possible trouble-free performance without frequent adjustments. They are adaptable to all new or existing pump designs and become part of the permanent pump assembly. Ask a C. Lee Cook representative to give you the details about this special liquid-pump packing.

WRITE FOR MORE INFORMATION

If you want Cook engineers to review the special requirements of your specific liquid-pump packing application, just send the necessary details to C. Lee Cook Company, 934 South Eighth St., Louisville 3, Ky. Or send for complete information about any of Cook's complete line of rings and packings.

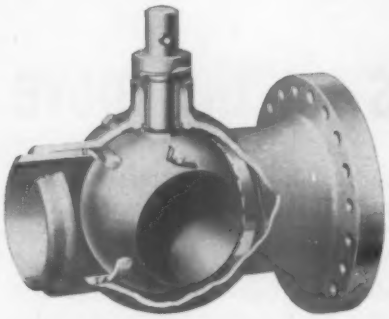
COOK SEALS LIQUIDS AT EXTREME PRESSURES AND TEMPERATURES

C. Lee Cook has unique experience in the advancement of liquid-seal technology. Recently completed research and development contracts (one with a major airframe and missile manufacturer) have resulted in new concepts of seal design, materials compatibility, friction limitations and sealing efficiency. If yours is a special packing application, call in a Cook representative.

C. LEE COOK
DIVISION OF DOVER CORPORATION
Rings and Packings Since 1888

8" x 6" x 6" 600 lb. ASA Flanged x Butt Weld Ball Valves on Pipeline meter run

CAMERON BALL VALVES



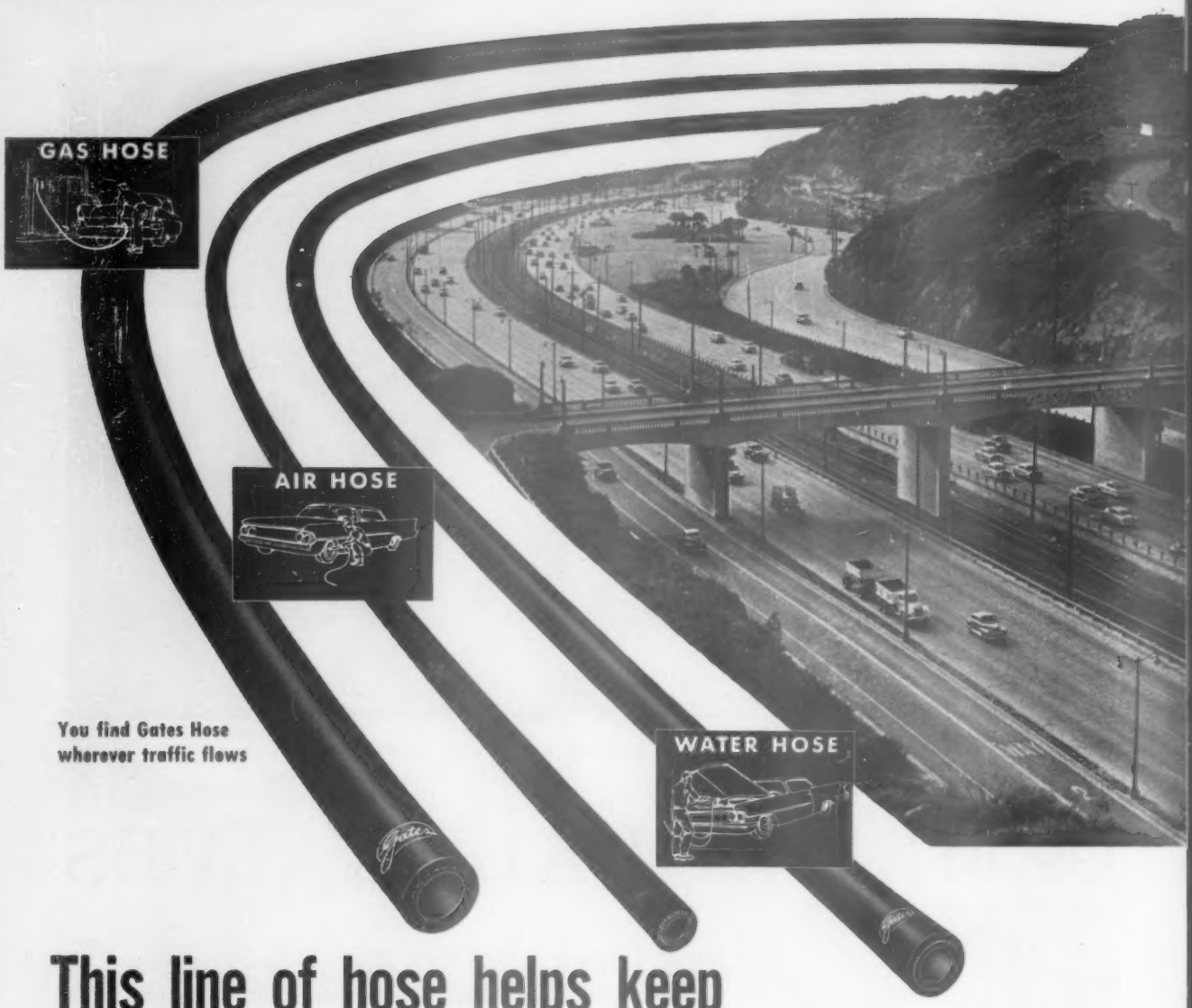
NEW — FOR GENERAL USE — for Pipe Lines — Chemical Refining and Gas Processing Plants — Oil Well Drilling and Producing

These valves, with the exclusive rotating seats, handle the most abrasive and corrosive fluids — cannot freeze — cannot develop excessive body pressure; they provide up-stream seating, double block and bleed, all with unbelievably easy operation.

They can be supplied in any material, size 2" to 36" and larger to required working pressures and with any type or style of operator desired. Cameron Ball Valves can be delivered from factories located in the United States, Canada, Mexico, England and France.

Cameron

CAMERON IRON WORKS, INC. • P. O. BOX 1212 • HOUSTON, TEXAS



This line of hose helps keep 70,000,000 vehicles on the move

To service some 70 million motor vehicles with gas, air, water and grease, this nation's 183,000 service stations use uncounted miles of hose. Because Gates is a major manufacturer of industrial hose, thousands and thousands of these stations rely upon Gates Curb Pump Hose, High Pressure Grease Hose, Air, Water and Low Pressure Steam Hose.

In back of this broad acceptance of Gates Hose is a continuing program of specialized hose research at the multi-million dollar Gates Research Center. The aim of this *specialized research* is to increase hose utility, lengthen hose life and lower industry's annual hose costs.

Because Gates Hose is so widely preferred, it is quickly available from leading distributors in all industrial centers. These Gates Hose Distributors are listed in the phone book Yellow Pages.

TPA502

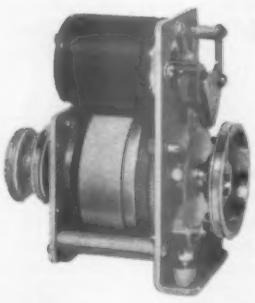
The Gates Rubber Company

The Mark of *Specialized* Research

Gates Industrial Hose

Made in a Full Range of Types and Sizes

ANOTHER Money Saving Feature OF *Taylor Instruments*



SERVO POWER

The powerful Servomatic motor in TRANSCOPE® Recorders and Transmitters, both pneumatic and electronic, is a plus feature that makes Taylor instrumentation more than ever your best buy.

The tremendous power of these servos not only overcomes friction and other problems associated with wear, it also means that the weakest signals, or the minutest changes in signal, are accurately registered and acted upon. It therefore assures unprecedented accuracy of recording and control.

Superior design, finest quality components and top-flight engineering combine to save you money in these areas:

- **You can maintain better product quality**—with accuracy of ½ of 1%, or ¼ of 1% if desired.
- **Your maintenance costs are reduced**—because rugged construction minimizes need for maintenance—and maintenance is simpler when required.
- **You can operate auxiliary equipment**—such as alarms, digital encoders and potentiometers because of the great reserve of power inherent in the servo motor.
- **You need a smaller inventory of parts**—and your operator training time is reduced.

* * *

Ask your Taylor Field Engineer to show you how servo power can help you cut costs and obtain better control.

Taylor Instrument Companies
Rochester, N.Y., and Toronto, Ont.

Taylor Instruments
MEAN ACCURACY FIRST

White Diesel, manufacturer of dependable, economical Superior engines—renowned throughout oil and gas fields for over 25 years, announces a new line of compressors. White compressors are medium speed, heavy duty, balanced opposed types, 200 to 1000 BHP, and are specifically engineered for combination with Superior natural gas engines.

The complete, compact, *matched design* engine-compressor package provides, continuous, heavy duty service for gas gathering, gas lifting, repressuring and booster applications. Two-cylinder and four-cylinder compressor models in a wide range of cylinder sizes can be ideally matched to Superior gas engine horsepower to meet your most exacting requirements.

Outstanding advantages...

MATCHED DESIGN Six inch stroke White compressors coupled to 9 inch and 10½ inch stroke Superior oil field gas engines provide optimum combinations of piston speed, horsepower and service life.

SINGLE RESPONSIBILITY White assumes complete responsibility for all engine-compressor parts . . . warrants both units one full year . . . offers factory service and replacements parts from its extensive oil and gas field service organization.

GREATER FLEXIBILITY Speed of direct-connected engines (no belts or gears) can be varied from 600 to 900 RPM for easy control of compressor output. Compressor cylinders can be easily changed on same frame to suit changing volume or pressure conditions.

EXTENSIVE CYLINDER RANGE Standard sizes range from 4000 PSI, 2⅝" dia. to 85 PSI, 22½" dia., providing 68 different cylinders. Custom sizes and designs also available.

MEDIUM SPEED POWER TO 1000 BHP Model W-62, two-cylinder compressor, ranges from 200 BHP with Superior 6G-510 gas engine to 635 BHP with 8G-825. Model W-64, four-cylinder compressor, is rated up to 1000 BHP with supercharged 8GX-825 gas engine.

CONTINUOUS HEAVY DUTY OPERATION Compressors are designed to accommodate 40 to 100% greater piston rod load than similar compressors. Rugged engine-compressors can run unattended, unprotected from weather, and can handle continuous operating loads and temporary overloads with ease.

Get new Compressor Bulletin 124 from White oil field representatives . . . or write today to White Diesel Engine Division!

WHITE DIESEL ENGINE DIVISION

THE WHITE MOTOR COMPANY

Plant and General Offices: Springfield, Ohio

635 H.P. Engine-Compressor Package.
Combination of Superior 8G-825 gas engine,
and White W64 four cylinder compressor.

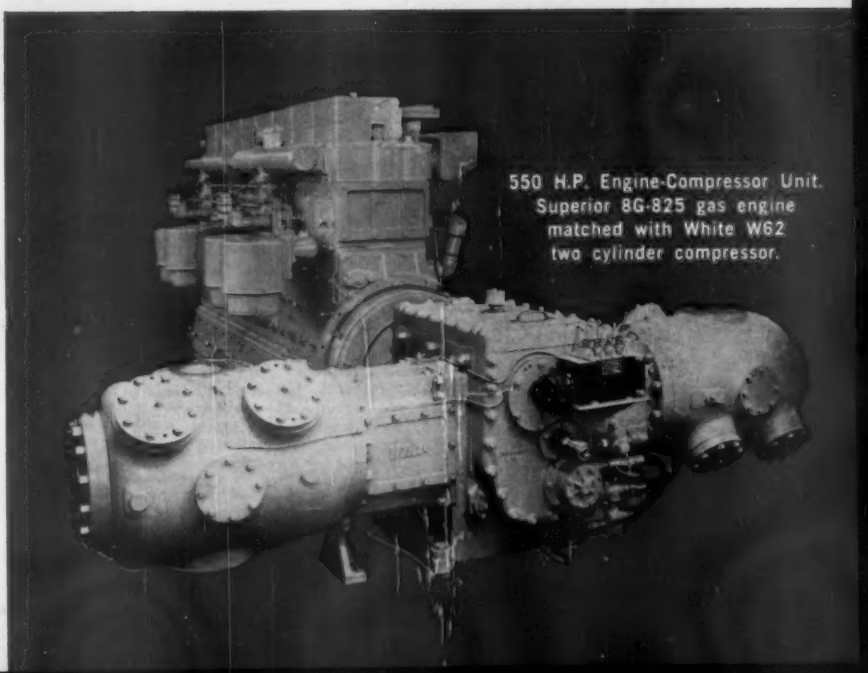
200 to 1000 BHP

Matched Design

ENGINE-COMPRESSORS

White DIESEL

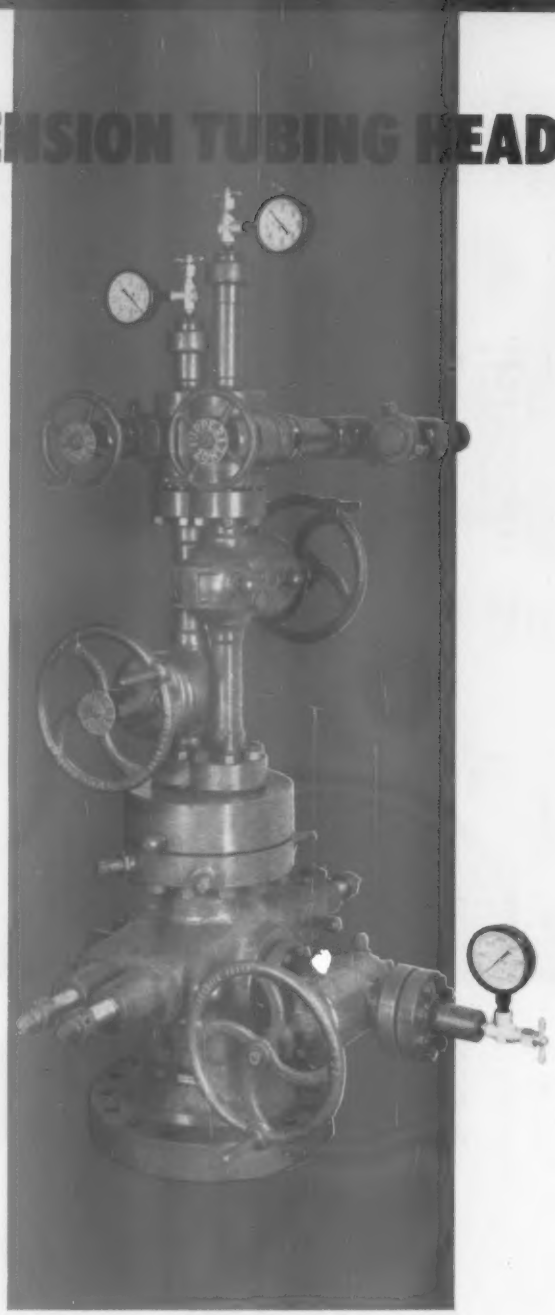
Superior ENGINES



550 H.P. Engine-Compressor Unit.
Superior 8G-825 gas engine
matched with White W62
two cylinder compressor.

O·C·T DRT DUAL TENSION TUBING HEAD

Set and manipulate parallel strings in tension faster, safer



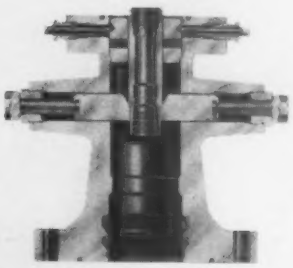
With this outstanding product of the Oil Center Tool Company, parallel strings of tubing can be set in controlled tension under blowout preventer control at all times. And flexibility, as in all O-C-T equipment, is an extra bonus. With the DRT, each string can be manipulated and set independently of the other.

Advantages of setting tubing in tension have been known for some time, particularly in the case of pumping wells where slack tubing strings result in high wear of rods and tubing. The advantages are even greater in the case of parallel tubing strings because of the much higher cost of workovers.

The O-C-T Dual Tension Tubing Head uses proved methods of sealing and supporting tubing. Action of both rams and sealing unit are direct and positive and both tubing strings may be run and set through blowout preventers with O-C-T Otis Back Pressure Valves installed. Annulus packoff is installed and activated before preventers are removed.

Available in full opening from 5½-inch to 7⅝-inch.

Contact the O-C-T representative nearest you for complete details about the DRT Dual Tension Tubing Head.



This cutaway drawing shows the independent supporting rams and seating element of the head. The packing around the tubing hangers is tightened by tightening hold-down screws.

O·C·T

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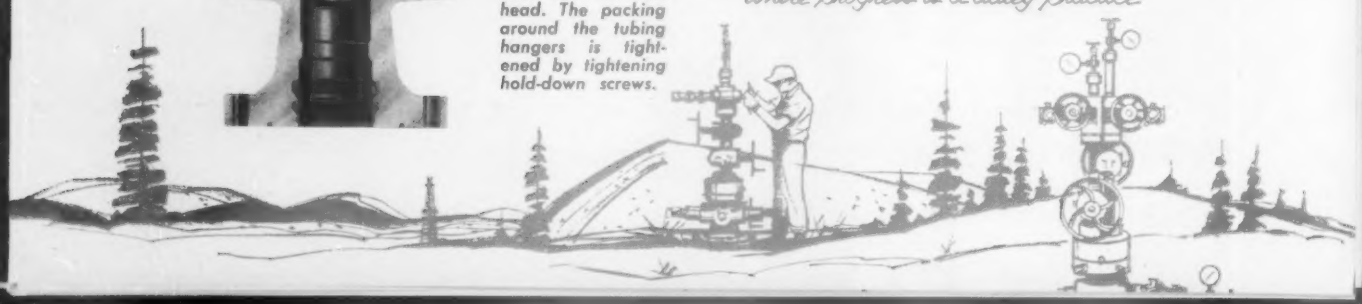

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They Say—

Confusing "hour"

Dear Sir:

The second sentence of the fourth paragraph of an article on page 84 ("Sodium Reaction Powers New Fuel Cell") of the December 26, 1960, The Oil and Gas Journal reads as follows:

"This experimental model will weigh between 2 and 3 lb. per kw. hour of capacity.

It is confusing to interpret this statement which possibly should not include the word "hour" so that the indicated weight is 2 to 3 lb. per kw.

Cornelius G. Weber
American Appraisal Co.

Reader Weber is right. "Hour" is an error.—Ed.

Conservation economics

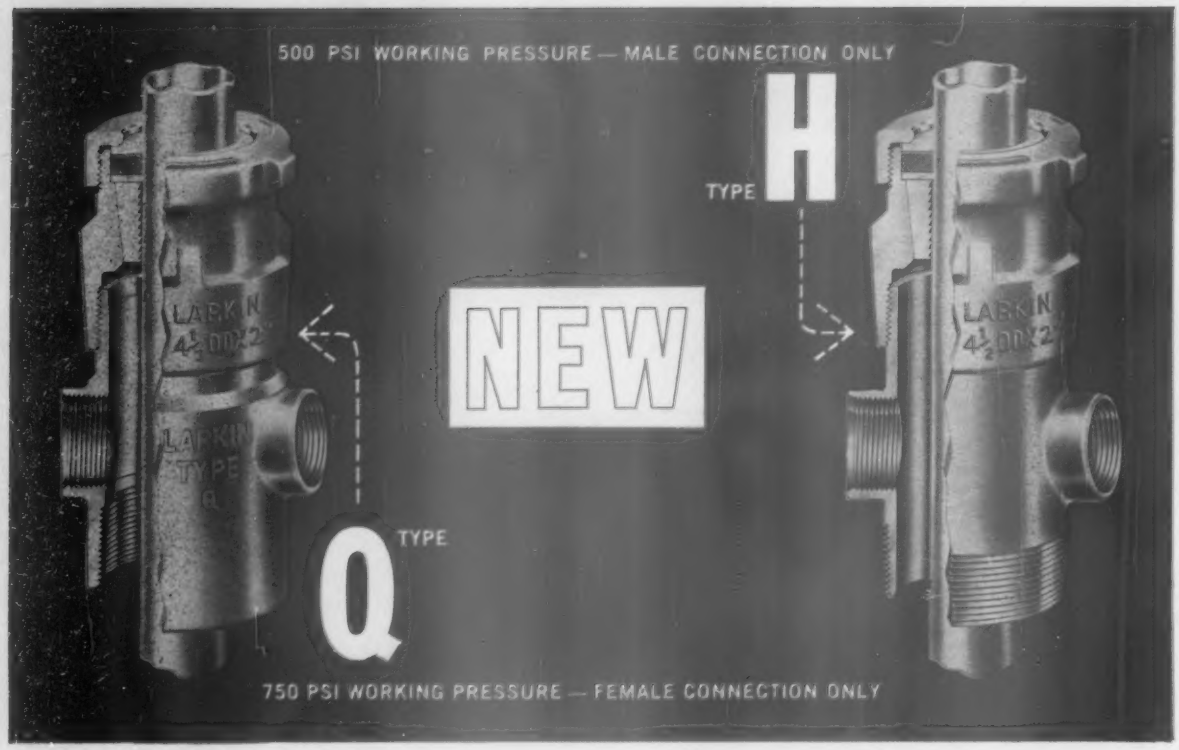
Dear Sir:

Congratulations on your editorial "Economic Waste Is Bad Conservation" (OGJ, Dec. 12, p. 73).

The American oil industry can be very proud of its record in having developed sound conservation techniques. No other nation has done as much pioneering work in this field. Admittedly, some states have been deficient by requiring, as you write, "overinvestment, inefficient practices, and unneeded producing capacity" which result in economic waste. However, over all the picture is good and deserves publicity, and your editorial is a step in the right direction.

To persuade the deficient states and the public in general that good conservation is good economics much more publicity, as well as education, is required. Colleges and universities should devote lectures to this subject, not only for petroleum industry students but also for students of other subjects.

We at New York University have discussed conservation economics for some years now as part of our economic geography courses. To judge by reports from oil companies who have interviewed our students as job applicants this teach-



Two new Larkin Tubing Heads

Two new answers to today's demand for economy

Larkin Type Q and Type H Heads bring to the low pressure field a completely new line of economical, high quality, slip-suspension tubing heads in a really complete range of sizes.

They are available in sizes from 2" Reg. or EUE tubing through 7" OD casing. Their three segment hinged slips will safely suspend up to 5000 feet of ¾" through 2½" EUE tubing or up to 3000 feet of 3" Reg. through 4" EUE tubing.

They are full opening in **all sizes.**

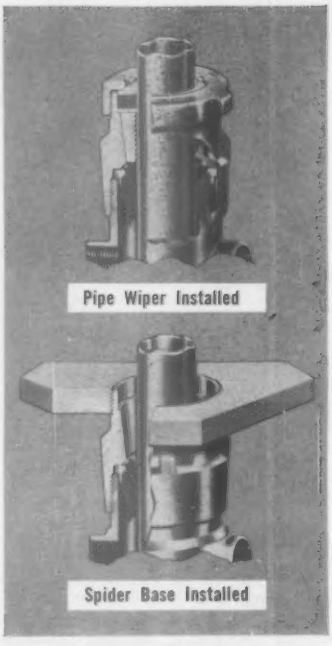
All cast parts are ductile iron pressure castings with more than adequate wall sections to provide generous safety factors. All steel parts are made of J-55 casing or of forgings with equivalent properties.

The Hycar Packing Ring is made of a high quality oil and gas resistant compound which has proved successful for many years.

All threads are current API threads which will conveniently accommodate valves or other control equipment.

Accessories which contribute to the versatility of these two new heads are the Spider Base and the Pipe Wiper which are illustrated. The Pipe Wiper will also hold pressures within the ratings of these heads. The Spider Base serves as a thread protector and a base for the tubing spider during workovers.

Type Q and Type H Tubing Heads are truly economical. Write us, or call your local Larkin representative for further particulars.



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LARKIN

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ing of conservation economics has been well received.

Alexander Melamid
Associate Professor
Economic Geography

Too busy to be sickly

"In the year just ended the Canadian oil producing industry was dissected, diagnosed, and viewed with alarm by various people. Is the industry really in distress?

"Let's take a look at a traditional test for the health of an industry: Its rate of growth.

"The oil and gas producing industry is growing faster than the general economy and, indeed, most other Canadian industries. Sales of western Canadian crude have been increasing at a rate relatively greater than the sales of oil from the prime producing areas of the United States, Venezuela, and the Middle East.

"Crude oil production alone is up approximately 4% over 1959. Oil and natural gas production has increased 10 to 12% over 1959. There is every indication that growth will continue at this or an even greater rate.

"Natural gas import projects already approved will mean, starting in 1962, additional sales of Canadian natural gas in the United States which will be equivalent to 150,000 bbl. daily of crude oil. Export markets for Canadian crude oil are also expanding. Sales for 1960 average out at an increase of 145% compared to 5 years ago, and a 23% increase over sales in 1959.

"Exploration for both oil and gas is continuing at a high level.

"If this is a sick industry, somebody should tell the 'patient' to lie down."

Editorial in the Imperial Oil Review, magazine of Imperial Oil Ltd.

Letters to They Say should be addressed to The Editor, The Oil and Gas Journal, Box 1260, Tulsa, Okla.

CALENDAR OF EVENTS

JANUARY

22-24 Kansas Oil Men's Association, annual convention, Broadview Hotel, Wichita.

24-27 Society of Plastics Engineers, seven-

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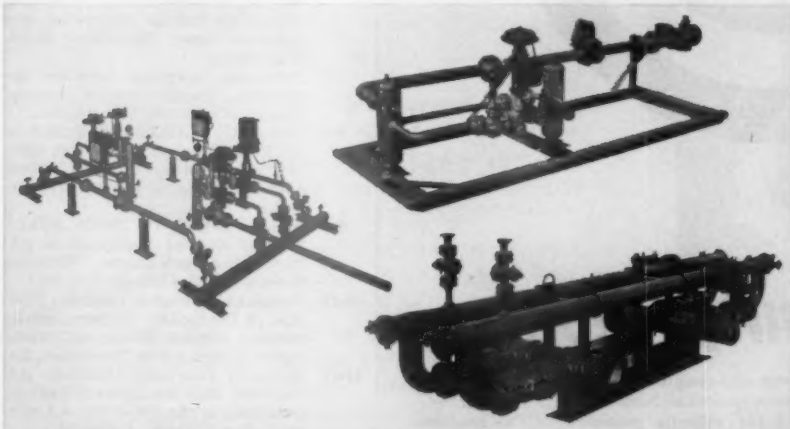

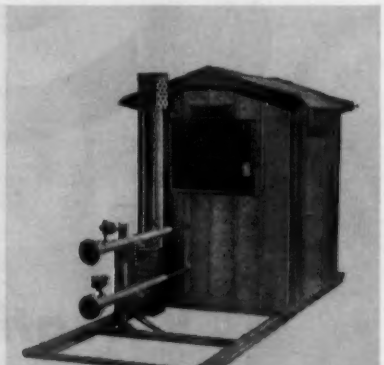

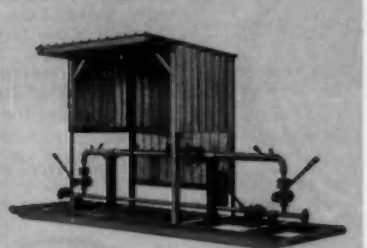

PACKAGED METER STATIONS

Start measuring gas immediately at the wellhead or at city gate sites with Daniel packaged, orifice meter stations. You save time in delivery, and save money in field labor costs with a complete Daniel package ready for tie-in to your line. Here are just a few examples of portable, skid-mounted units built by Daniel to customers' specifications. Each unit can be tested and X-rayed at the modern Daniel plant before shipping, and fitted with the meters of your choice. Want more facts? Write for Bulletin MS-1.

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3352 Union Pacific Avenue
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teenth annual technical conference, Shoreham Hotel, Washington, D. C.

25-27 Texas A & M College, sixteenth annual symposium on instrumentation for the process industries, College Station, Tex.

26-27 American Chemical Society, Southeastern Texas Section, fourth symposium on hydrocarbon chemistry, Shamrock Hilton Hotel, Houston.

30-Feb. 9 University of Illinois, annual quality control short course, Urbana, Ill.

FEBRUARY

2 Petroleum Equipment Suppliers Association, south Mid-Continent district meeting, Statler Hotel, Dallas.

7 Petroleum Equipment Suppliers Association, Gulf Coast district meeting, Shamrock-Hilton Hotel, Houston.

7-8 University of Oklahoma, School of Petroleum Engineering, advanced petroleum engineer seminar, University of Oklahoma, Norman.

8-10 Southwestern Legal Foundation, twelfth annual institute on the law of oil, gas, and taxation, Southwestern Legal Center, Dallas.

9-10 API Committee on Public Affairs, New Orleans regional conference on employe communications, Roosevelt Hotel, New Orleans.

9-11 National Society of Professional Engineers, winter meeting, Hotel Fort Des Moines, Des Moines, Iowa.

14 Petroleum Equipment Suppliers Association, eastern district meeting, Duquesne Club, Pittsburgh.

14-15 National Association of Corrosion Engineers, Shreveport, La., section, short course, Centenary College, Shreveport.

15-16 Western Petroleum Refiners Association, Gulf Coast regional technical-industrial relations meeting, Rice Hotel, Houston.

16 API Committee on Public Affairs, Dallas regional conference on employe communications, Sheraton-Dallas Hotel, Dallas.

18 Purdue University, business history conference, "Management Decisions Under Government Regulation," Memorial Union, Purdue University, Lafayette, Ind.

20-Mar. 11 Advanced Drilling Practices Course for Engineers, University of Oklahoma, Norman.

23-24 Oklahoma State University, natural-gas conference, Stillwater, Okla.

24 Natural Gasoline Association of America, South Louisiana regional meeting, Lafayette Petroleum Club, Lafayette, La.

26-Mar. 1 American Institute of Chemical Engineers, petrochemical and refining exposition, Municipal Auditorium, New Orleans, and national meeting, Hotel Roosevelt, New Orleans.

26-Mar. 2 American Institute of Mining, Metallurgical, and Petroleum Engineers, annual meeting, Chase and Park Plaza Hotels, St. Louis.

28-Mar. 1 API Committee on Public Affairs, New York regional conference on employe communications, Park-Sheraton Hotel, New York City.

MARCH

2 Petroleum Equipment Suppliers Association, north Mid-Continent district meeting, Mayo Hotel, Tulsa.

3 Ohio Oil and Gas Association, winter meeting, Deshler Hilton Hotel, Columbus.

5-9 American Society of Mechanical Engineers, gas-turbine power division, and U. S. Department of Defense, annual gas-turbine conference and products show, Shoreham Hotel, Washington.

7 Petroleum Equipment Suppliers Association, Pacific district meeting, Ambassador Hotel, Los Angeles.

7-8 University of Oklahoma, School of Geological Engineering, seventh biennial geological symposium, Student Union Building, University of Oklahoma.

8-9 API Committee on Public Affairs, Chicago regional conference on employe communications, Sheraton-Towers Hotel, Chicago.

8-10 American Petroleum Institute, Division of Production, southern district meeting, Captain Shreve and Washington-Youree hotels, Shreveport, La.

13-16 Kentucky Petroleum Marketers Association, sixth management institute, conducted by the University of Louisville, Brown Hotel, Louisville.

13-17 National Association of Corrosion Engineers, annual meeting and corrosion show, Hotel Statler, Buffalo, N. Y.

15-17 Natural Gasoline Association of America, annual convention, Baker Hotel, Dallas.

16-17 International Oil and Gas Educational Center, study of the economics of petroleum exploration, development, and property valuation, Southwestern Legal Center, Dallas.

21-23 American Power Conference, twenty-third meeting, Sherman Hotel, Chicago.

22-24 American Petroleum Institute, Division of Production, southwestern district meeting, Cole Hotel, Albuquerque.

23 National Industrial Conference

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Versatility-Economy

Now you can reduce costs and simplify valve specifying by using the highly versatile and economical Norriseal Wafer Type Butterfly Valve. Designed for working pressures to 150 psi, the Norriseal Valve features removable and interchangeable rubber and metal seats . . . takes up less line space . . . can be easily and quickly removed for "on-the-spot" maintenance . . . is field repairable. The wide selection of trim available qualifies the Norriseal Valve for use in many oil field and industrial applications.

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"WE LIKE EVERYTHING ABOUT IT... ESPECIALLY INCREASED PRODUCTION"

reports Ronnie Cook, Project Superintendent for Young and Anderson Co., Brea, California. Behind this enthusiastic statement—performance of a power shift Cat D8 Tractor pioneering a 36-inch pipeline between Newberry and Cucamonga.

Here where rock and tough conditions are the rule, the power shift transmission makes a tremendous difference. "This D8 is the greatest thing yet," continues Mr. Cook. "Power shift transmission sure gives the tractor plenty of get-up-and-go. Without a good means of checking we think very conservatively it has increased production at least 10-12%." And the operator adds, "Power shift takes the work out of operating—the machine practically runs itself. Even a twelve-hour shift doesn't tire me out."

These are typical of the comments coming in about the optional Cat power shift transmission with exclusive torque divider. It combines the snap and economy of a direct drive transmission with the anti-stall and acceleration-against-load of a torque converter.

Like every Caterpillar component, power shift transmission is tough—one rugged ton built with the precision of a fine watch. Unit construction makes it easy to service, if required. For complete details, see your Caterpillar Dealer. He'll demonstrate how the power shift D8 can boost production on even your toughest pipeline job.

Caterpillar Tractor Co., General Offices, Peoria, Ill., U.S.A.

POWER SHIFT TRANSMISSION

- One control lever does it all —no clutching!
- Shifts on-the-go under full load in split second!
- Changes to all speed ranges, reverses direction without braking!

MORE D8H FEATURES

Size — 2½ tons heavier than former model, massive heavy-duty undercarriage, highest ground clearance (19⅞") in class

Power — 235 HP Cat D342 Engine with power-boosting, fuel-saving turbocharger

Operator Convenience — in-seat starting, console-mounted controls, unobstructed deck, contoured seat cushions, improved visibility

Maintenance — lifetime lubricated track rollers, dry-type air cleaner, common lube system for key drive train components

Plus a complete line of matched tools and attachments for every application.

CATERPILLAR

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STEP UP PRODUCTION WITH POWER SHIFT TRANSMISSION

Board, general session, Shamrock-Hilton Hotel, Houston.

27-29 Midwest Gas Association, annual meeting and convention, Sheraton-Fontenelle Hotel, Omaha.

27-31 Instrument Society of America, symposium on temperature measurement and control in science and industry, Veterans Memorial Auditorium, Columbus, Ohio.

28-29 University of Oklahoma, Schools of Petroleum and Gas Engineering, gas conditioning short course, Oklahoma Memorial Union Building, University of Oklahoma, Norman.

APRIL

4-5 University of Kansas, gas compressor institute, Liberal, Kans.

5-7 American Petroleum Institute, Division of Production, Mid-Continent district meeting, Mayo Hotel, Tulsa.

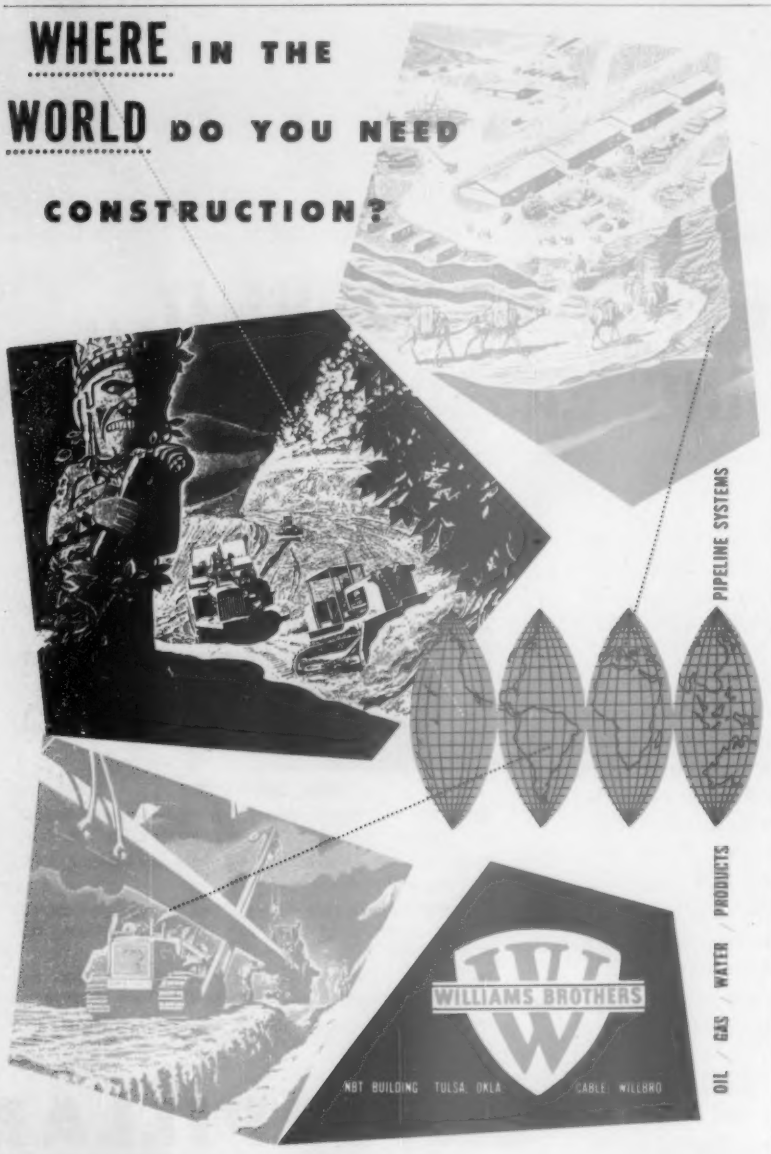
6-7 University of Oklahoma, School of Mechanical Engineering, short course on industrial engines, University of Oklahoma, Norman.

7-9 American Institute of Mining, Metallurgical, and Petroleum Engineers, Southwestern Alaska Chapter, sixth annual mining, minerals, and petroleum conference, Anchorage, Alaska.

10-11 American Society of Mechanical Engineers, maintenance and plant engineering conference, Bancroft Hotel, Worcester, Mass.

10-12 Western Petroleum Refiners Association, annual meeting, Granada Hotel, San Antonio, Tex.

10-13 American Society of Mechanical Engineers, oil and gas power conference and exhibit, Jung Hotel, New Orleans.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11-13 Petroleum Industry Electrical Association and Petroleum Electric Supply Association, annual conference, Moody Convention Center, Galveston, Tex.

17-19 Instrument Society of America, symposium on instrumental methods of analysis, Shamrock-Hilton Hotel, Houston.

18-20 University of Oklahoma, southwestern gas measurement short course, North Campus, University of Oklahoma, Norman.

19 University of Tulsa, fifteenth annual conference of accountants, University campus, Tulsa.

19-20 National Petroleum Association, semiannual meeting, Hotel Sheraton-Cleveland, Cleveland.

20-21 Society of Petroleum Engineers of AIME, East Texas-Louisiana-Arkansas gas-technology symposium, Tyler, Tex.

20-21 Texas Technological College, annual West Texas oil lifting short course, Lubbock, Tex.

20-22 Illinois Society of Professional Engineers, annual convention, Peoria, Ill.

24-26 Southern Gas Association meeting, New Orleans.

24-27 American Association of Petroleum Geologists, Society of Economic Paleontologists, and Rocky Mountain section of AAPG, annual meeting, Denver Hilton Hotel, Denver.

26-28 American Petroleum Institute, Division of Transportation, pipeline conference, Chase-Park Plaza Hotel, St. Louis.

27-28 Rocky Mountain Oil and Gas Association, midyear meeting, Northern Hotel, Billings, Mont.

28 Natural Gasoline Association of America, Oklahoma regional meeting, Lake Murray Lodge, Ardmore, Okla.

30-May 2 Independent Petroleum Association of America, midyear meeting, Roosevelt Hotel, New Orleans.

30-May 3 Liquefied Petroleum Gas Association, convention and trade show, Conrad Hilton Hotel, Chicago.

MAY

3-5 American Petroleum Institute, Division of Production, Rocky Mountain district meeting, Gladstone-Henning Hotel, Casper, Wyo.

4-5 Society of Petroleum Engineers of AIME, oil recovery conference, Midland, Tex.

4-5 Pacific Coast Gas Association, Inc., transmission conference, Biltmore Hotel, Santa Barbara, Calif.

7-10 American Institute of Chemical Engineers, meeting, Sheraton-Cleveland Hotel, Cleveland.

8-11 American Petroleum Institute, Division of Refining, midyear meeting, Rice Hotel, Houston.

9-11 Western Joint Computer Conference and Exhibit, Ambassador Hotel, Los Angeles.

10-12 American Society of Mechanical Engineers, production engineering conference, Royal York Hotel, Toronto.

10-12 Canadian Institute of Mining and Metallurgy, oil and gas division, and Calgary and Edmonton petroleum engineering sections of Canadian Institute of Mining and Metallurgy and American Institute of Mining, Metallurgical, and Petroleum Engineers, annual meeting, McDonald Hotel, Edmonton, Alta.

11-12 American Petroleum Institute, Division of Production, Pacific Coast district meeting, Biltmore Hotel, Los Angeles.

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50 years ago

January 26, 1911

Some of the old-time enthusiasm of Spindletop is being revived in recently opened Vinton field of southwestern Louisiana where wells making 10,000 to 15,000 bbl. daily are coming in in rapid order. Vinton is taking the spotlight from declining-boom Caddo field of northwestern Louisiana, and now-retiring Markham field of South Texas.

Flames shooting several thousand feet into the air and visible more than 200 miles at sea are devouring more than 100,000 bbl. of oil daily in Mexican Eagle Petroleum Co.'s wild well in Dos Bocas territory on the Mexican Gulf Coast. The blowout, one of the largest wells in history, has forced all inhabitants within a 50-mile radius to desert their homes. All animal life in the region has been killed by the dangerous fumes.

25 years ago

January 23, 1936

Ohio Oil Co. completes its Kyle discovery well of the Big Medicine Bow structure in Carbon County, southeastern Wyoming, as a dual-zone producer. Ohio claims it is the first well in the country to be completed with production from two zones, each flowing independently of the other in the same hole. By an ingenious device worked out by John MacFadyen, vice president and head of the production department, the well flows oil through the tubing, and gas through the casing.

Significant field developments during the week included completion by E. H. Moore and associates of a giant oil producer in Oklahoma's prolific new Fitts field, in Pontotoc County, and a 2-mile northeast extension of northwestern Louisiana's booming new Rodessa field. The Fitts gusher flowed 1,657 bbl. in an hour's test, or at the rate of more than 39,700 bbl. daily.

10 years ago

January 25, 1951

New York ceremonies formally inaugurate initial deliveries of natural gas through Transcontinental Gas Pipe Line Corp's newly completed 1,840-mile, 30-in. pipeline from Texas. Initial delivery rate of 80 M.M.c.f. daily to be built up gradually to full quantity of 251 M.M.c.f. daily.

Petroleos Mexicanos and Gulf Oil Corp. reach agreement for purchase by Pemex of Mexican Gulf Oil Co., Gulf's subsidiary in Mexico, for $2,350,000. The Gulf subsidiary is one of a group of companies not included in Mexico's 1938 expropiation.

JOURNALLY SPEAKING

Names Is Names

(Since everybody else on the staff has been busy totting up statistics on the 1960 in preparation for our annual Review and Forecast issue next week, Sara Duncan, our Personals Editor, got in the act too. She analyzed the names of oil men she wrote about during the year and came up with these enlightening statistics.)

ANYTHING can be proved by statistics, we thought as we searched the Journal's Personals "name" file, not knowing exactly what we wanted to prove.

No trend was established in the survey, but some interesting facts showed up.

The ideal "oil" name for instance, may well be Johnson or Johnston. With 52 in our file the Johnson-Johnstons outnumber all others. And, for a first name, well, how about Monroe? If you want your boy to be an oil executive, this might be a good bet as Shell's recent appointment and Jersey's of a few years ago indicate.

To succeed in oil your name needn't be as easy to say and spell as Johnson, however Oily names come in all sizes and varieties.

A quick flip of our file of cards produces these hard-to-spell examples: Aoki, Braeckel, Bruynzeel, Couvillon, Deily, Faggioli, Kokotailo, Loofbourrow, Maescher, Maio, Manteuffel, Mazidi, Negishi, Mygdal, Pollitzer, Puumala, Rafidi, Russum, Sakamaki, Salvatori, Sauermilch, Schellentrager, Sidebotham, Splittgerber, Yabroff.

And, we don't know about you, but pronunciation of some of these puzzles us: Sawhney, Doig, Haag, Hjerpe, Inchalik, Jicha, Knaak, Krouskop, Mlcak.

An article in the Saturday Evening Post of some months ago was devoted to the findings of an IBM machine used by the Social Security people. The machine provided first statistics on the number of family names in America. The number and variety, it seemed, surpassed all previous estimates. Well, we believe it.

Have you heard that the number of Joneses is creeping up on the number of Smiths in America? 'Taint so. In oil, the Smiths are way ahead. There are 44 of them, and only 29 Joneses in our file.

The nobility seems to be doing well in oil.

There are 10 Kings, 1 Queen, 3 McQueens, 3 Knights, 1 McKnight, 1 Duke, but alas, no Princes lately.

The occupation names abound too. Our file shows 30 Millers, 10 Bakers, 6 Potters, 6 Butlers, 4 Barkers, 1 Archer, 5 Marshalls, 2 Gardners, 11 Walkers, 3 Abbotts, 6 Cooks, 15 Taylors, and 4 Weavers.

As for place names, there are 2 Hedges, 16 Woods, Woodsides, and the like, 6 Brooks, 7 Halls. And directions . . . we have 5 Easts and Easternlings, 9 Wests, 1 Northrop, no Souths, but a few Sutherlands.

Animals are in the file too. A quick check shows 1 Hare, 4 Lyons, 1 Lamb, 2 Wolfes (Wolves?), 1 Swan, 5 Foxes, 2 Fish (and 9 Fishers). There are varieties of Fish too . . . Herring, Pickerell, and 2 Trouts.

Browns lead the color names with 32. There are also 15 Whites, 10 Blacks, counting variations; 8 Greens (or Greene); 4 Grays. No Blues currently, but there is 1 Pinkman.

The file shows 2 Smarts, but no Dumb; a couple of Biggers, but no Smalls.

There's a Mr. Friday active in oil, and a Mr. May. Also, a Summers, a Winter, 2 Springers, and 1 Fall.

Of political interest: there are 4 Kennedys filed, but only 1 Nixon. And we always thought Nixon was more of an oil man.

—*Sara Duncan*

CONTINUING . . .

in '61

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Pressure is growing for modernizing state rules

OKLAHOMA has now joined the growing list of states which encourage wide spacing of wells by granting higher allowables.

Within recent months Mississippi, Nebraska, Utah, and North Dakota have approved the development of fields with 80 acres or more per well and have given inducements for other new fields to be wide spaced.

Modern technology has proved beyond doubt that many types of reservoirs will produce as much oil at lower cost with fewer wells than once was thought necessary. It is good to see some state conservation bodies putting this principle into practice.

SOME OTHER STATES could well follow these examples, notably Texas and Kansas. In both those states revision of conservation rules is under active discussion but making scant progress.

The key to wide spacing—or to any orderly drilling pattern—is the pooling of individual interests within a drilling unit, whether the unit be one acre or one section. This gives every divided-interest owner an undivided interest in a jointly owned well.

There is nothing difficult or oppressive about such pooling. The majority of oil states have regulations which make the procedure smooth and routine. None of them would consider abandoning the practice.

Pooling does deprive a surface owner of the right to drill his own well on his own tract, just as a city zoning ordinance may prevent him from building any kind of structure he desires. But it doesn't take his right to recover the oil under his lease. On the contrary, it enables him to recover his oil at less cost than if he drilled his own well.

What pooling does take away from a small-tract owner is the right to depreciate the value of adjacent property by draining oil from it or forcing neighbors to the expense of drilling needless offsets. This so-called right is the heart of the opposition to wide spacing.

In this enlightened age it is anachronistic for important oil states to let this type of opposition be an obstacle to adoption of a measure like proper well spacing which will reduce the over-all costs of producing oil without impairing the correlative rights of an individual producer.

THE UTMOST EFFICIENCY in producing practices is required to keep domestic oil competitive with foreign oil and with other fuels State authorities have an obligation to encourage cost-cutting methods which will not impair ultimate recovery.

Operators migrate to areas where they can get the best payout. States which encourage wide spacing by a pooling rule and an adequate acreage factor in the allowables formula can attract development away from those that don't.

With several states now taking the lead in modernizing their conservation rules to fit today's conditions, pressure on the others to do so can be expected to build up rapidly.

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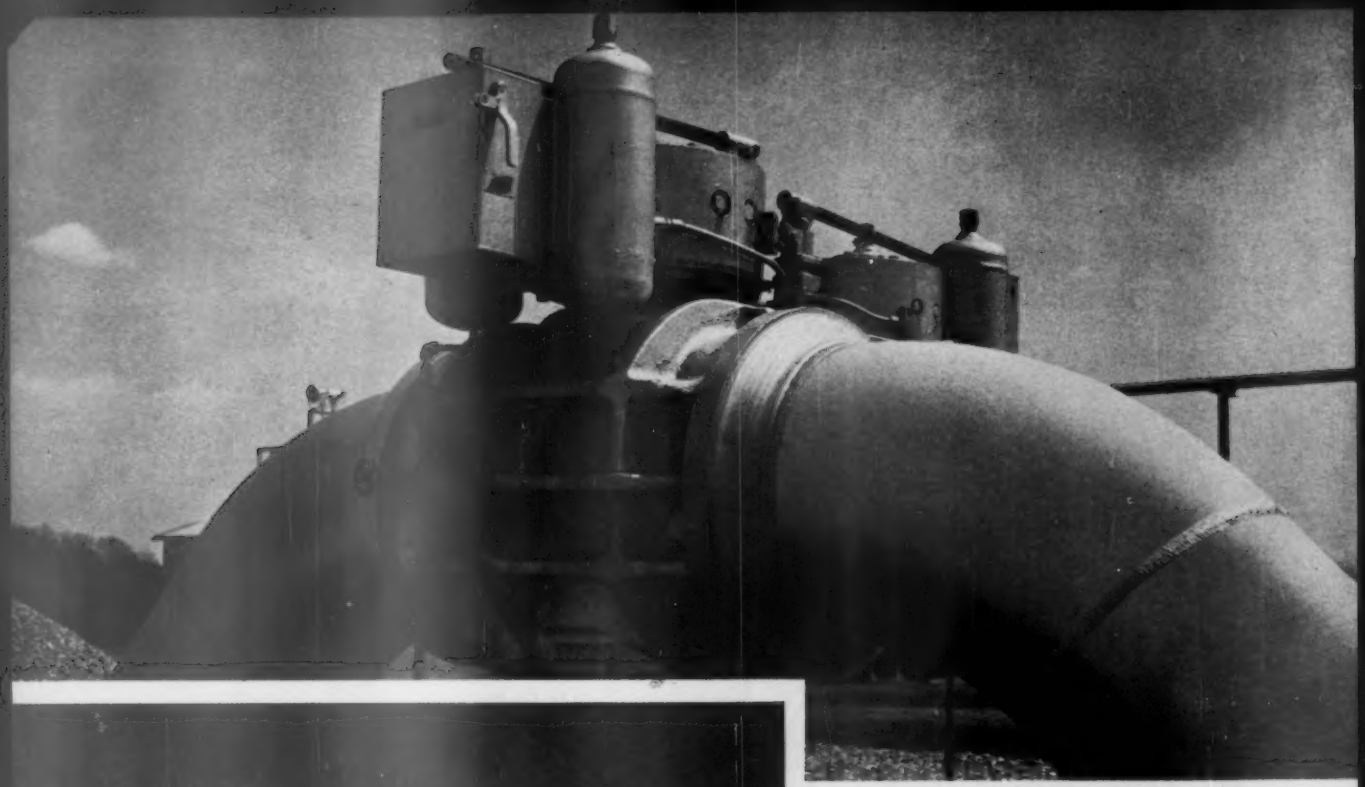

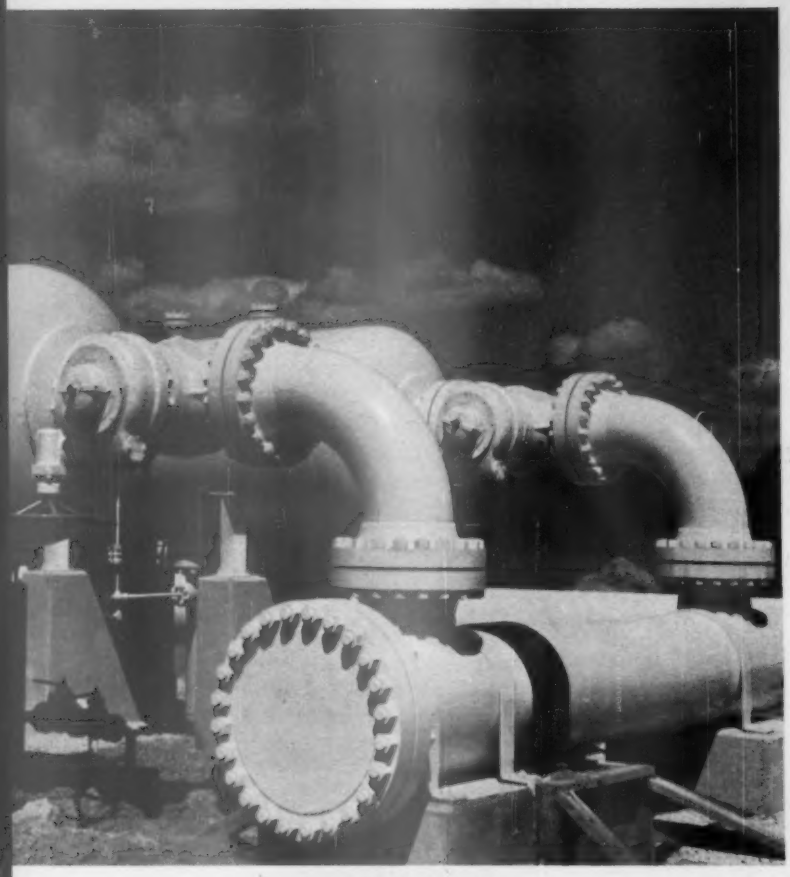

Men who plan and lay pipelines with J&L line pipe also prefer famous names in valves and fittings. Rockwell-Nordstrom, OIC, W-K-M, Stockham, Taylor Forge . . . all products in the "best available" class. Taylor Forge WeldElls and flanges and Rockwell-Nordstrom lubricated plug valves are featured "on location" here.

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While the Bank is prepared to provide all available information on the oil industry, it does not make recommendations regarding the purchase of individual oil stocks.

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RESOURCES EXCEED $3,000,000,000

Most company budgets are now set for '61. Confidential figures from over 60% of the industry reveal . . .

Capital Expenditures in Oil and Gas				
(In millions of dollars)	Planned 1961	Change from 1960 %	Spent 1960	Spent 1959
Drilling and prod.	3,600	+0.6	3,580	3,900
Refining	468	+27.5	367	334
Petrochemicals	326	+77.2	184	129
Marketing	570	+14.7	497	467
Total Transportation	1,325	+3.0	1,286	1,148
Natural-Gas P.L.	1,066	+6.6	1,000	950
Crude and Prod. P.L.	134	−4.3	140	80
Other	125	−14.4	146	118
Total	6,289	+6.3	5,914	5,978

How Industry is Budgeting in '61

George Weber
Editor

THE PETROLEUM industry plans to invest more than $6¼ billion in the U. S. this year. This proposed outlay tops last year's by 6.3%.

This isn't the greatest budget the industry has made. But it may turn out to be one of the firmest. A year ago oil and gas companies reported plans to spend $6¾ billion. But before the year was out, domestic budgets had been trimmed by $844 million.

Today the outlook is better. Product prices are relatively firm, indicating a better year for profits retained for further investment. In each division, budgets look more realistic.

The prospect for suppliers, service companies, and contractors serving oil and gas is for a moderately good year. But they may not realize much improvement in their business until well into 1961.

1. Drilling

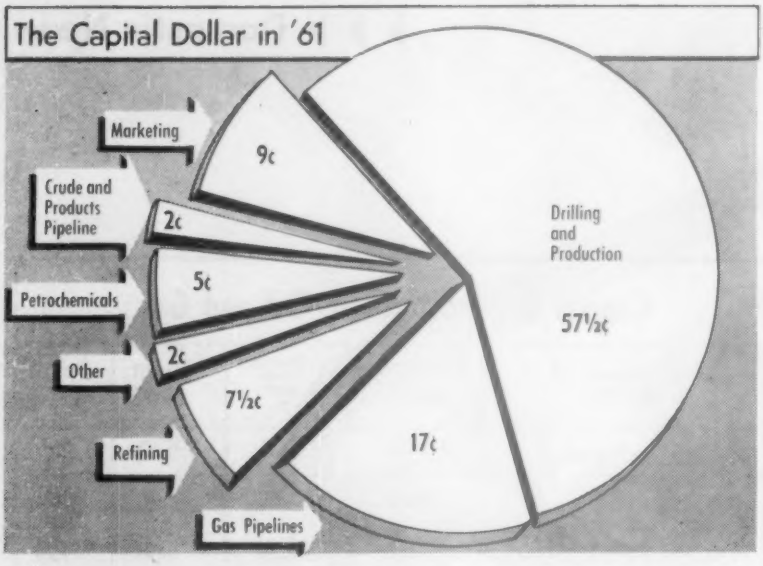
Capital spending in this division will rise less than 1%. This is in line with the comprehensive drilling survey now being compiled for the Journal's Annual Review and Forecast Number, January 30. Total wells to be drilled nearly equal last year's figure.

But there's a difference in the type of wells. A much larger proportion will be wildcats. Wildcats cost more to drill. In addition, some of them will discover oil or gas, calling for development programs not now anticipated. This, plus the fact that many oil-company stocks of pipe and other supplies were worked down during 1960, makes this estimate look firm, if not conservative.

While the estimate of $3.6 billion for drilling and production represents a large sample of the industry, it is recognized as an estimate.

Many small companies and independents cannot project their drilling activity for a full year with accuracy. Much depends on the availability of capital and the quality of prospects they encounter. But the indicated boost in wildcatting is an encouraging factor. After a period of cost-cutting which hit exploration hardest, the trend appears to be turning upward once again.

Production expenditures not related to new drilling represent a minor share of this total figure. Secondary recovery will continue



active this year with no sharp departures upward or downward.

2. Refining

Investment here will take a sharp jump this year.

The 27.5% increase over 1960 looks startling until it is viewed in proper context. Both 1959 and 1960 were extremely quiet on refinery construction. The industry is still saddled with over 1.5 million barrels per day in excess crude capacity. Moreover, the octane race has all but halted and refiners need little new capacity for upgrading gasoline or other products.

Nearly half of the returns are now in for the Journal's annual refining survey which will be published April 3. They reflect little new construction committed to date. Of 150 refineries reporting, only 20 list new units. New crude capacity is almost infinitesimal and additions to downstream processing are few.

On the other hand, obsolescence is taking its toll. After a prolonged period of inactivity, refiners must begin replacement of marginal uneconomic capacity. The 27.5% upturn from 1960 indicates that this replacement program will be under way before the year is over. The bulk of new products is yet to be announced, but 1961 bids to see a revival of new construction.

But the volume of new building will be nominal since the increase is registered on a very low base. Expenditures of $367 million in 1960 and $468 million this year are very low by comparison with the mid-fifties, when rapid amortization and larger yearly gains in demand led to a runaway construction program.

3. Petrochemicals

Petrochemicals are hot this year, so far as the oil industry is concerned.

A record building program is under way to give oil and gas companies a greater share in this growth industry.

For the first time, the Journal survey separates chemicals from refining expenditures. All but a few companies broke out their chemical spending as requested. And the figures are most interesting.

The 77.2% increase over 1960 budgets reflects scores of new projects in benzene, naphthalene, styrene, olefins, and polyolefins. In addition, the petroleum industry is expanding its share of the finished-product market for films, fibers, detergents and scores of other end-use items.

Note that this petrochemical investment is only part of all expenditures in this class of chemicals. Companies outside the petroleum industry still budget the bulk of new capital. But oil is moving more swiftly into the picture, witness this year's record outlay.

4. Marketing

Expenditures of $570 million in marketing are not justified on the basis of new demand this year. But they weren't last year, either.

The continued gain in this category reflects the brisk pace of marketing competition expected in 1961. Many companies are expanding geographically by purchasing existing outlets or by building new ones.

Marketing budgets of this order are a sign of the times. The industry is already overbuilt on service stations. But thousands of new ones will appear this year as possibly thousands of marginal outlets close.

This is not alone a battle of the giants. The independent marketer with or without his own refining facilities is also strongly in this picture. Large marketing budgets held fairly firm last year. The industry will probably spend this allotment again this year.

5. Pipelines

Gas pipe lines are headed for a record construction year. New projects, primarily in the West will keep contractors busy throughout 1961. Last year was a big one for new gas lines. This year should top it by more than 6%.

As expected, the laying of new crude and products lines will ease off this year. The moratorium on refinery expansion, for the present at least, calls for little new capacity for moving crude.

Most new activity will be in LPG lines in the Southeast and Midwest this year, but elsewhere the picture is quiet. The same is true for investment in tankers, trucks, tank cars, and other capital goods in petroleum transport.

6. The "K" Factor in Spending

The question often arises "Why do capital expenditure forecasts sometimes fall wide of the actual mark?"

The answer is clear. Individual companies often depart from their first-of-year budgets. Majors and independents alike find it difficult to project their expansion with accuracy a year in advance. The year 1960 was a good example.

One year ago, the capital expenditures forecast included a large minus "K" factor. But no one could foresee it at that time. Cost-cutting

had already taken some of its toll in the budgets then set up.

But product prices eroded, and the industry adjusted to a lower rate of spending as the year wore on. Majors and independents drilled much less than they anticipated. The industry as a whole pared its drilling and production budget by 12½% before the year was over. Most of this slowdown occurred in the ranks of small companies and independents.

A direct comparison of money budgeted and money actually spent in drilling and production, as reported by 15 major oil companies, showed that they reduced their projected outlay by 4%.

The same trend held in refining expenditures. The Journal forecast is based on a sample which represents 81.5% of U. S. crude runs during 1960. The companies reported that they actually spent 22.6% less than they expected to at the beginning of the year.

Oil and gas companies submitting confidential figures to the Journal survey represent 87% of oil industry activity in petrochemicals. Although direct comparison is not possible, since petrochemicals were not split out from refining a year ago, the budgets set a year ago apparently held fairly firm.

The marketing division also kept closely to its budget last year. All companies reduced their spending by only $11 million or 2.2% from the level anticipated a year ago.

Transportation, primarily in areas other than pipelines, also encountered some setbacks in 1960. The industry failed to spend its budget by about 7%. This same cutback was reflected in comparing the returns from the same companies at the start and close of the year.

As in all forecasts, the estimates are only as good as the individual company figures compiled at the beginning of each year. In retrospect, the industry was overoptimistic a year ago by a "K" factor of about 12½%.

Today, the best appraisal of 1961 expenditures indicates that they are more realistic. If the industry exercises restraint in control of refinery runs and stocks, and product prices hold firm, these 1961 figures could prove to be conservative. But not by much. The "K" factor for 1961 may well approach zero.

Udall Says He Plans to Listen

STEWART L. UDALL, new Secretary of Interior, is keenly aware that he has a lot to learn about the oil industry and Interior Department's involvement with it.

As a result, he will lean heavily at the outset on advice from others. He told Washington oil reporters recently that he plans to consult with industry experts.

Udall approves "generally" of the oil - import - control program, but thinks it needs strengthening and tightening. He did not indicate what he feels is wrong with it at present.

Close associates of Udall say he considers oil problems as perhaps the most touchy issues under his jurisdiction, and that he plans to spend considerable time in becoming familiar with them.

His first major exposure to the industry will be at the February 7 meeting of the National Petroleum Council in Washington. It's expected he will ask the NPC to be more active than ever in making oil and oil-related studies for the Government.

He may choose that meeting to disclose the new administration's views on the antitrust aspects of oil advisory groups such as the NPC.

There was no tip-off on Udall's oil plans when he was called before the Senate Interior Committee in a recent confirmation hearing.

The reason: Not a single oil question was asked by committee members. They bombarded him with questions about power and dam projects, Indian affairs, and other issues affecting the West and Far West particularly.

Secretary Udall

This was not surprising because most members of the committee are from western states.

Udall handled this line of questioning well. As an Arizonan, he was familiar with the subjects.

Udall did put himself on record on one oil-related matter. He favors multiple use of public lands, although he said he thinks it important for some wilderness areas to be given complete protection in order to preserve them in their natural state.

Phillips Barred from Union's Board

A PRELIMINARY injunction barring Phillips Petroleum Co. from representation on Union Oil Co.'s board of directors has been signed by a federal judge in Los Angeles.

Judge Pierson M. Hall signed the injunction with the consent of Phillips, Union, and the Justice Department. The department filed an antitrust case against Phillips following the company's purchase of 15% of Union's stock.

The injunction also prevents Phillips from buying any additional Union stock or from voting its present shares.

Another stipulation requires Phillips to notify the Government if it sells 25% of its Union stock.

George Haddock, of the Justice Department's Los Angeles office, said the third-party requirement was sought so the department would have "the opportunity to look at any stock transaction of this kind." He pointed out Phillips might gain a spot on Union's board by selling a block of stock to someone "closely associated" with Phillips.

Phillips was scheduled to file an answer to the Government's antitrust charges January 23, but the company has been granted a month's delay.

New Conservation Regulations Coming in

• Deep drilling and wide spacing will be encouraged under new formula for setting allowables. Order implementing new rules due out about March 1.

OKLAHOMA will soon be operating under a new set of conservation regulations.

The new rules, just approved by the Oklahoma Corporation Commission, provide a new depth-acreage formula for setting allowables to encourage deep drilling and wide spacing.

They also permit prorating water floods, change the discovery allowable and salt-water exemptions, and tighten up procedures in general.

The commission is expected to order the regulations into effect as soon as they can be printed and distributed, probably about March 1. The revision is the result of more than 2 years of study, following widespread criticism that many Oklahoma practices were sloppy and obsolete.

Most important change is the new depth - acreage allowables scale. It sets up so-called "basic" allowables for all wells, but these will be subject to uniform percentage changes from month to month as determined by market demand.

Each month the commission will determine total market demand for Oklahoma crude and then assign each well an allowable computed by applying a uniform percentage figure to the table of basic allowables. In practice this will mean that shallow, closed-spaced fields will bear a bigger proportion of cuts in total state allowables than they have in the past, with deeper wells getting better treatment.

Present practice is to give "unallocated" pools a flat basic allowable, which currently is 17 bbl. per day but which recently was 14 bbl. per day. Allocated pools then get this basic figure as a minimum allowable, and this graduates upward on a depth-bracket scale.

Under the current market demand for Oklahoma crude, it is expected that requirements could be met by allowables about 35 or 40% of the figures in the basic scale. This would mean, for example, that wells less than 1,000 ft. deep and on 10-acre spacing would get about 8 bbl. per day instead of the 20 in the basic scale—or 17, as in January. The same percentage reduction would be applied to all other figures in the allowables table.

Unallocated pools . . . In the past, most pools in Oklahoma under 4,800 ft. have been classified as unallocated and assigned a maximum allowable on a lease basis, meaning that allowables could be shifted among wells in order to average out.

The new rules require reclassification of all fields in the state, with the "unallocated" label applying only to those where per-well allowables and other restrictions aren't considered necessary to prevent waste or to protect correlative rights.

Unallocated pools will continue to get lease allowables, but they will be subject to the depth-acreage scale and to market-demand fluctuation. However, an operator has the option of having a good well on a lease transferred to the allocated classification.

Salt-water exemption . . . Exemptions from allowables for wells making excessive salt water have been tightened. Instead of complete exemption, such a well will get only double the basic 10-acre allowable for its depth bracket, but not to

How Depth-Acreage Allowables Will Work

THIS SCALE starts with an arbitrary basic allowable of 20 bbl. per day per well for wells on 10-acre spacing or less producing from less than 1,000 ft.

The 10-acre column increases by 200-ft. depth brackets.

A well on 20-acre spacing gets 25% more allowable than a 10-acre well in the same depth bracket. A well on 40-acre spacing gets 25% more than a 20-acre well. A well on 80-acre spacing gets 25% more than a 40-acre well.

Thus 80-acre spacing almost doubles the allowables of 10-acre spacing. Under the old rules, wells of the same depth received the same allowable.

New Sliding Scale

(Basic barrels per day per well, subject to uniform percentage factor monthly to adjust total to market demand)

Avg. depth of pool (ft.)	10 acres or less	20 acres	40 acres	80 acres
0-1,000	20	25	31	...
1-bbl. increments per 200 ft. in 10-acre "basic."				
5,601-5,800	45	58	72	90
2-bbl. increments per 200 ft.				
9,201-9,400	81	101	127	159
3-bbl. increments per 200 ft.				
10,001-10,200	95	119	148	185
5-bbl. increments per 200 ft.				
11,001-11,200	122	153	190	239
8-bbl. increments per 200 ft.				
12,201-12,400	173	215	269	338
10-bbl. increments per 200 ft.				
14,801-15,000	303	379	473	593

Oklahoma

exceed the best water-oil ratio. Further exemption can be obtained only on special application and for good cause.

Water floods . . . The new rules tighten procedures on special allowables for water floods and pressure-maintenance projects. Allowables will be assigned on a lease or unit basis, but only for producing wells (injection wells not included). Until a special order is granted for a particular project, the allowable will be only that in the depth-acreage table.

To qualify as a water flood, a project must inject at least as much fluid as is produced. Until qualifying, a project will get only the basic allowable but thereafter it will get a project allowable of 20 bbl. per producing well. Higher allowables may be granted on special showing after a hearing.

However, water-flood allowables will apply only to wells producing from the zone being flooded, and only to wells on developed acreage actually being stimulated by the flood.

All water-flood projects are to be reexamined and reclassified by the commission within 60 days after the regulations become effective. These new provisions are expected to wipe out the allowables exemptions from many so-called water floods and otherwise eliminate abuses which have been strongly criticized in Oklahoma.

Discovery allowable . . . The new discovery allowable will be twice the currently applicable allowable for wells in pools of comparable depth, spacing, and characteristics, for 30 days. In the past, the discovery allowable has been a flat 150 bbl. per day for 60 days. This change is expected to work a hardship on shallow-pool openers while benefiting deep wildcats.

Drilling restrictions . . . Among the various procedures tightened up by the new regulations are those applying to drilling and plugging. No permit system as such is instituted, but no drilling or workover may commence until the operator has received an approved duplicate copy of his notice of intention to drill and this has been posted at the well site.

There are stiff bonding requirements to guarantee complying with regulations and filing required forms such as logs and completion reports.

No allowable will be assigned a well until all casing and other provisions have been met. There have been many complaints that in the older producing areas, some operators have drilled wells and either put them into production or abandoned them without complying with prescribed procedures and without letting the commission know anything about these wells.

NEW RULES were announced last week by Ray Jones, member and former chairman of the Oklahoma Corporation Commission, at the Tulsa meeting of the Oklahoma Independent Producers Association.

Computer Will Run Cat Cracker

. . . at Gulf's Philadelphia plant. Closed-loop control is expected to raise efficiency of the 60,000-bbl. unit.

CLOSED-LOOP computer control is being applied to Gulf Oil Corp.'s 60,000-bbl.-daily fluid catalytic cracker at Philadelphia.

A Thompson-Ramo-Wooldridge RW-300 digital computer will be used in the automatic system.

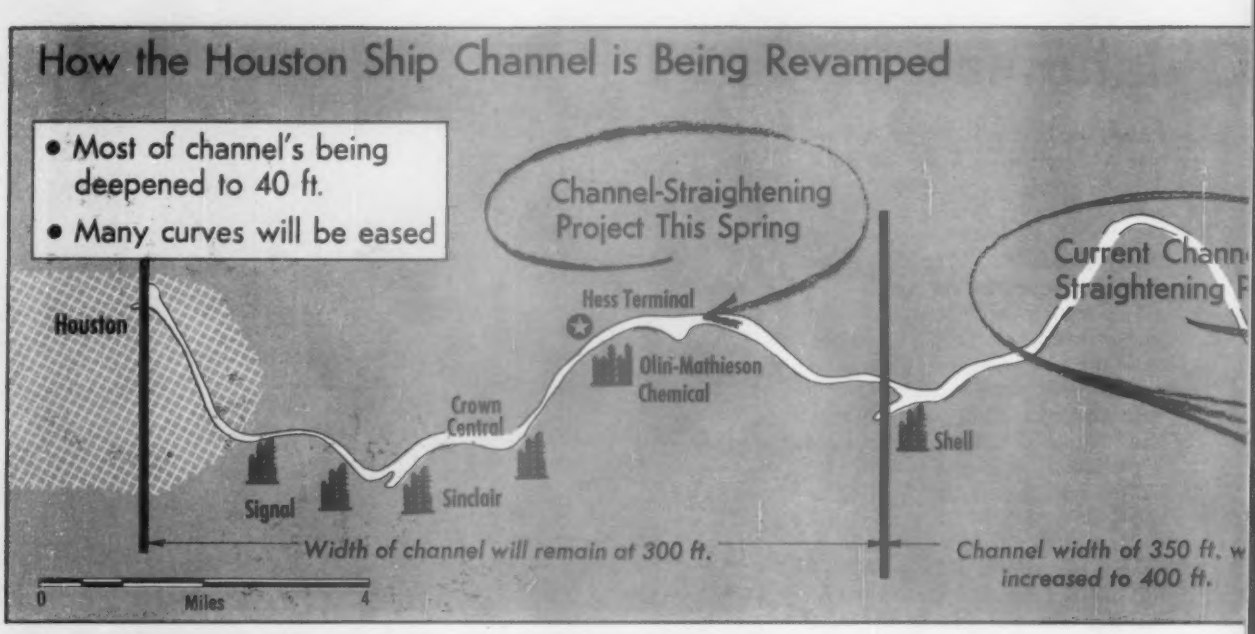
Gulf and TRW officials said a joint study showed the computer would raise the cat cracker's operating efficiency to 95% of theoretical maximum. This will be achieved mainly through closer control of reactor temperature and recycle ratio, two major process variables.

The initial system will have about 150 inputs (analog and digital). Inputs include data from process-stream analyzers and an end-point analyzer.

Major products of the cat cracker are high-octane gasoline stocks, liquid butanes, liquid propanes, and fuel oils.

The transistorized digital computer has built-in analog-to-digital conversion circuits. It will be installed in a control room along with an operator's console and control panel, automatic typewriter, and signal transducers.

Gulf expects the system to provide valuable experience in computer control of involved refining operations, in addition to direct economic benefits.



New Project Opening Houston Channel to

Howard M. Wilson
District Editor

THE HOUSTON ship channel—home of six major refineries and a host of oil terminals and chemical plants—has just finished one big widening and deepening project and is starting another.

The purpose: To accommodate larger tankers for the oil industry.

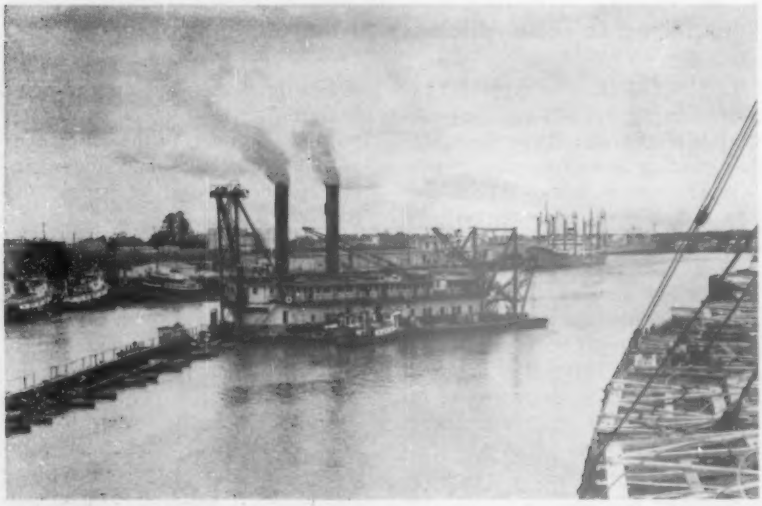
Work on the new project will proceed as swiftly as Congress appropriates the money. A formal beginning was made recently when Army Engineers took bids on a $2.5-million curve-easing job in the Baytown area.

When the full $19-million project is completed, the channel will be straighter, 4 ft. deeper most of the way, and 50 ft. wider in its middle section.

This means fully loaded tankers of 40,000-ton size will be able to move upstream within 2 miles of the channel's turning basin, which is inside the Houston city limits.

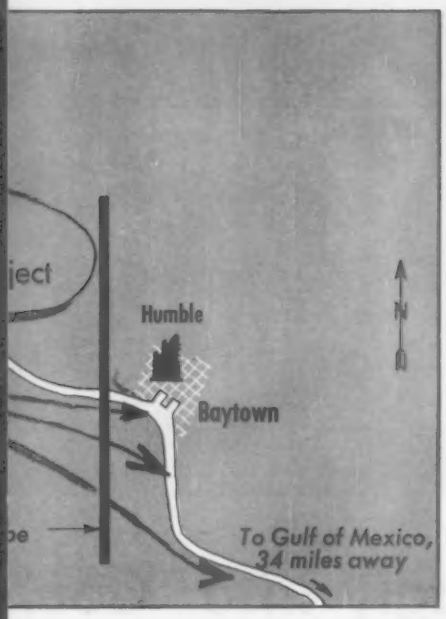
What's past . . . In 1960 the Army Engineers and the Port of Houston wound up a long-term project, authorized in the 1940's, to deepen the channel to 36 ft. and widen it to 400 ft. in the lower section, 350 ft. in the middle section, and 300 ft. in the upper section.

Even as this was being done, tankers were getting bigger. It was



DREDGES maintain the Houston ship channel at 36 ft. and will deepen it . . .

TO LET fully loaded tankers of the sam



Bigger Tankers

obvious that the channel would have to be made even deeper and wider.

Building for the future is an old story with the channel, which made the 50-mile-inland City of Houston accessible to deep-sea traffic 45 years ago.

Today the channel can accommodate all the major freighters of the world. But freighter business accounts for only 15% of the Port of Houston's tonnage. The big traffic is in petroleum, credited with about two-thirds of the port's handling total of 60 million tons a year. This total makes the port second only to New York in tonnage handled.

Since Humble built its Baytown refinery toward the lower end of the channel in the World War I era, refineries also have been installed by Shell, Crown Central, Sinclair, and Signal—two plants by the latter.

Phillips, Hess, Texaco, Gulf, Warren, Ethyl, and many others have terminals, chemical plants, and operations that require tanker or barge service for crude or product movement.

Through the years, the channel has been deepened periodically from the original 25 ft. to 30, 32, 34, and 36 ft.

What's planned . . . Before the latest phase of deepening and widening begins, engineers are tackling a number of bends that handicap vessels.

The Baytown-area contract calls for slicing off a curve opposite the Humble refinery. This will eliminate a navigation hazard. Two other down-channel curves also will be eased.

A second contract, to be awarded in March, will do the same thing for three curves upchannel near the Hess Terminal and Olin-Mathieson Chemical. Two of the curves flank Olin-Mathieson on the south side of the channel, and the third is directly across from the company's plant.

Other bend-easing jobs are scheduled for the entire length of the channel, and dredging will continue on a regular basis. But the deepening and widening must depend on congressional funds, and these may be spread over several years.

Plans call for deepening the channel to 40 ft. all the way to Brady Island, site of the uppermost refinery. The widening will make the channel 400 ft. broad from a point 5,000 ft. above the Humble refinery at Baytown to Boggy Bayou, just above the Shell refinery. This 7.5-mile mid-section of the channel is 350 ft. wide at present.

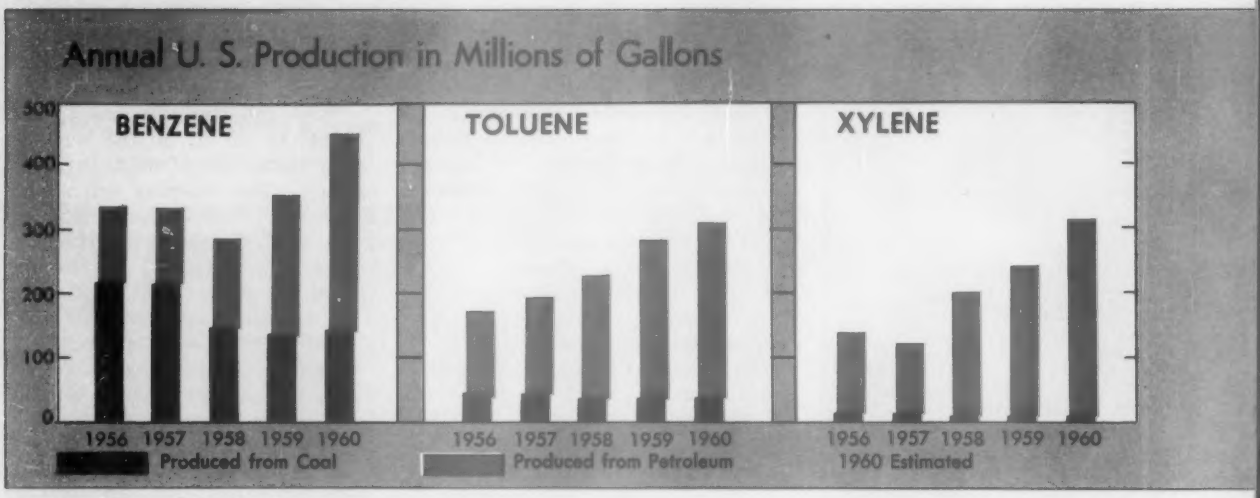
After the widening project is finished, the channel will be 400 ft. from Boggy Bayou to the Gulf of Mexico. It will remain 300 ft. wide from Boggy Bayou to the turning basin, but curve-easing and deepening will make this 11-mile section easier going for larger tankers.

Who does it . . . Congress authorized the current widening and deepening project in 1958 and made the first appropriation of $1.1 million last year.

The Port of Houston's share of the work consists of acquiring the right-of-way for widening and straightening, and providing soil-disposal areas. The port also has its own $12.5-million building program. This, already under way, includes $2 million for channel right-of-way acquisition, a $4-million bulk-handling facility on Green's Bayou, additional wharves and rail-truck accesses, and a $3-million 11-story World Trade Center building in downtown Houston. Revenue bonds are paying for all this.

ass as this 40,000-ton Sinclair behemoth . . .

TRAVEL upstream to within 2 miles of the channel's turning basin.



Oil Is Moving Strongly Into "Coal

D. H. Stormont
Refining Editor

THE AROMATIC chemicals are rapidly changing parents.

For years these were coal-derived chemicals. But oil companies have moved into the field and are now calling the tune in both production and marketing.

And, as oil moved in, so did mass production. The result: Aromatics are now petrochemicals and they stand to become far more important chemicals in volume and use.

Only one of the four in the charts—naphthalene—is still produced entirely from coal. But this will change in 1961. Much of the new aromatics capacity now under construction or planned is designed for naphthalene production.

Oil's renewed interest in aromatics stems in part from industry developments of the past 2 years. Product realization has declined because of excess inventories and weak gasoline markets. At the same time, demand for octanes has dropped.

In order to boost profit margins, more light aromatics are being recovered as petrochemicals. Formerly they would have ended up as motor-fuel components.

While this has been going on, strikes and curtailed output in the steel industry have acted to cut coal-aromatic supplies. And the outlook there hints at a further decline.

Naphthalene has been in particularly short supply. In 1958, some 58 million pounds had to be imported. The next year, imports ran close to 60 million pounds. Imports fell off again last year, but only because of an expanding European demand.

The oil industry's concentration on naphthalene will retouch this picture vividly. Five plants announced within the past 6 months will have an annual capacity of 375 million pounds, almost four-fifths of coal's 1960 naphthalene output.

The completion of these new plants this year and in 1962 will mark the end of coal's monopoly in the naphthalene field. Petrochemical naphthalene in 1963 may well equal that obtained from coking.

Benzene is the second most active aromatic. Domestic supplies have risen more than 30% in the past 5 years, but increasingly large amounts had to be imported to help meet demands.

Recently four new petro-benzene projects have been announced, with a combined capacity of about 125 million gallons a year. Other new facilities with a total capacity of about 100 million gallons are in the works.

Petroleum versus coal . . . Petroleum-produced aromatics of all kinds now greatly exceed those from the coking and coal-tar industries.

In 1950, the year when petrobenzene was first produced in commercial quantities, it was a different story. Then petrochemical aromatics amounted to less than half of the amount produced from coal. Petrochemical aromatics didn't take the lead until 1955.

Benzene production by oil companies tripled to more than 300 million gallons last year, about twice the production from coal. Oil's toluene and xylene output, according to U. S. Tariff Commission data, more than doubled.

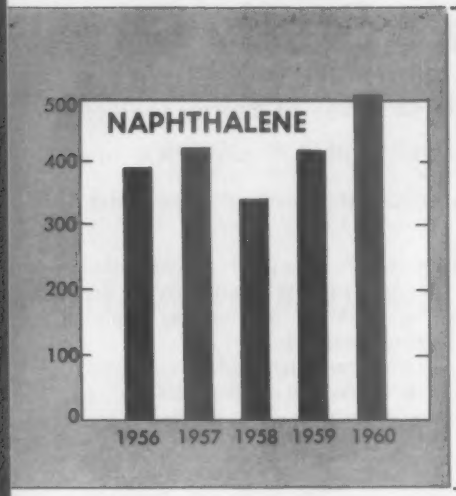
Last year, benzene from coking totaled less than 150 million gallons compared with 225 million gallons in 1956. Toluene and xylene showed comparable drops.

Coal's future . . . Supplies of coal aromatics show little promise of improving.

Coke-oven capacity is available for higher outputs but steel-industry operations don't require the coke. And without the basic income from coke, coal aromatics can't compete with petrochemical aromatics.

On top of all this, two proposals for eliminating coke in blast furnaces are being studied.

One process, the H-Iron method, produces iron directly from the ore by reduction with hydrogen obtained from natural gas or fuel oil.



Aromatic Production Trends in the U. S.

(Naphthalene in 1,000 gal., others in 1,000 lb.)

	Benzene		Toluene		Xylene		Naphthalene
	Coal	Oil	Coal	Oil	Coal	Oil	Coal
1960*	148,000	306,000	33,800	275,000	8,600	312,000	510,000
1959	138,300	208,800	30,600	251,000	8,000	233,500	425,300
1958	145,000	142,100	32,200	207,400	9,000	191,500	345,100
1957	215,300	116,200	42,600	154,900	12,100	115,100	420,300
1956	225,000	111,600	42,800	130,800	12,200	124,100	491,400

*1960 figures based on first 10 months data. Source: U. S. Tariff Commission.

Chemical" Field

The method is being tried in a 50-ton-daily plant and is being installed in a 110-ton experimental unit.

The other method uses residual fuel oil to supply part of the heat in blast furnaces. A large-scale test was carried out last fall at a blast furnace in Hamilton, Ont. (OGJ, Oct. 24, 1960, p. 72).

Supplemental fuel-oil firing is not expected to be workable in all blast furnaces. But if it gets a good foothold, oil consumption might be increased by some 250,000 bbl. daily—all at the expense of coke.

Construction stepped up . . . U. S. oil-industry capacity for producing benzene will total about 550 million gallons annually in 1962 if all plant and expansion projects are carried out. This compares with a present capacity of about 325 million gallons.

The latest projects were announced only last week. Crown Central Corp. will complete a major unit this year at its plant on the ship channel near Houston for making benzene, toluene, and xylene. Gulf Oil Corp. also is planning a multimillion-dollar benzene plant at its Philadelphia refinery.

Previously, Monsanto Chemical Co. and Enjay Chemical Co. had announced big projects. Monsanto will complete a 42-million-gallon benzene plant near Alvin, Tex., in 1962. This complex also will contain a 50-million-pound naphthalene plant and a 500-million-pound ethylene unit.

At Humble's Baytown, Tex., refinery, benzene facilities are to be expanded from 30 million to 55 million gallons. The project, which also calls for toluene capacity to be stepped up from 32 million to 55 million gallons, will go into operation early next year.

Other benzene plants to be constructed by Mobil Chemical Co. at Beaumont, and by Texaco Inc. at Port Arthur, each will have an annual capacity of 30 million gallons.

Toluene, which has a smaller chemical market than benzene, is showing little growth at this time.

About one-third of the petrochemical xylene output, which last year topped 300 million gallons, also is blended back into gasoline. Total U. S. capacity is now about 340 million gallons.

Demand is rising for xylenes like phthalic anhydride and isophthalic and terephthalic acids. Ortho-xylene is in high demand because of the naphthalene shortage. Phthalic-anhydride manufacturers have been turning to ortho-xylene as an alternate or supplement.

Petrochemical naphthalene will become a reality when Ashland Oil & Refining Co. completes its 75-million-pound plant at Catlettsburg, Ky., in the next few months.

Scheduled for completion late this year are the naphthalene plants of Sun Oil Co. at Toledo, Ohio, and the Tidewater Oil Co.-Collier Carbon & Carbide plant at Delaware City, Del. Both will have an annual capacity of 100 million pounds.

In addition to the Monsanto naphthalene plant mentioned earlier, Tidewater and Collier have announced plans for a 50-million-pound plant at Los Angeles.

All of the petro-naphthalene will be produced by hydrodealkylation of cuts segregated from catalytic reformer streams.

Next Week:

A Recap on 1960 and Forecast for '61

THE INDUSTRY'S most revealing report of the year will come your way in The Oil and Gas Journal's Annual Review and Forecast Issue of January 30.

This valuable 65-page report presents important statistics and an interpretation of the figures on drilling, production, demand, refining, pipelining, and other significant aspects of the industry.

It will forecast 1961 refinery runs, pipeline construction, well completions, and the demand and supply outlook for petroleum.

Watch for this reliable summary and forecast in next week's Oil and Gas Journal.

Oil Favors an Impartial Fuels Study

• Industry leaders endorse an unbiased, high-level survey of energy sources and needs. But, with coal's aggressiveness in mind, both API and IPAA say they'll fight any effort toward government dictation of how fuels are used.

THE OIL INDUSTRY has made it clear that it favors an impartial fuels study.

It has made equally clear that it will continue to oppose any effort to have the Government dictate to consumers the type of fuel they must use.

This industry attitude was underlined last week in a letter to John F. Kennedy from Frank Porter, president of the American Petroleum Institute, and in a statement issued by the executive committee of the Independent Petroleum Association of America.

The IPAA statement offering to make available all necessary information to any government study groups followed a meeting of its executive committee in Houston.

API view . . . Porter's action came after a second meeting in Washington of a cross-section of oil-industry representatives who discussed at length what they thought the industry should do in view of the aggressive push by the coal industry for a fuels study.

One of the points discussed was whether the industry should advocate a fuels study by a special commission appointed by the President or a study by Congress.

Porter left this question open in his letter to Kennedy.

"Regardless of the route decided upon or the body assigned to the subject by the President and/or Congress, the petroleum industry stands ready to offer its fullest cooperation and participation," Porter said.

Porter pointed out that the industry has participated in similar studies before and that it would continue to do so "whenever the President, the Congress or the public deems it necessary.

"The American petroleum industry is keenly aware of the importance to this country of the continued availability of low-cost and abundant fuel resources."

Coal Men Happy

OFFICIALS of the National Coal Policy Conference were happy over last week's statements in which oil-industry officials voiced their willingness to cooperate in an objective study of the nation's energy resources.

NCPC officials feel that this development will add momentum to a move under way in Congress for a fuels review.

A resolution setting the stage for the study, introduced by Sen. Jennings Randolph of West Virginia, had been signed by 45 senators late last week. There were indications that the list of co-signers would soon move past the 51 needed for a majority.

He warned the new President, however, that "certain" proposals designed to create a so-called new national fuels policy "are subject to grave question."

Porter pointed out that the leading supporter of a "fuels policy" was the coal industry.

This, he said, was an obvious effort by coal to gain advantage over competitors, "despite the overwhelming consumer preference for cheaper and more convenient oil and gas."

He said any policy that forced consumers to switch to "less desirable" fuels would be dangerous to the public well-being and "inimical to the principles on which this nation and its economy are founded."

Oil's view, Porter said, is that the most successful fuels policy this nation can have is one of free consumer choice among competing fuels.

IPAA view . . . In its statement, the IPAA executive committee stressed that the industry is not "backtracking" or changing a past policy.

The committee said its organization has never opposed studies of petroleum policies or studies of the oil industry.

It has opposed—and will continue to oppose — any program which would result in end-use energy control by the Government, according to Alvin Hope, IPAA president.

The background . . . Most oil leaders have opposed the coal industry's approach since the National Coal Policy Conference set out in 1959 to push through Congress a resolution calling for establishment of a national fuels policy.

In its original wording, the resolution made it clear that the coal industry was advocating some form of end-use control.

When opposition to the resolution succeeded in stalling its progress in Congress, coal leaders agreed to a rewording of the resolution—eliminating any reference to end-use controls and leaving up to a congressional committee whether the nation needs a new fuels policy or not.

Even so, many oil representatives felt that any study set up as a result of coal's proposals could very well be a biased one.

Therefore considerable opposition continued, although some oil spokesmen warned that such opposition might make it appear that the oil industry was afraid of a fuels study.

With the advent of a new administration, it became increasingly clear that some type of fuels study—whether by the administration or by Congress — was very likely. This was especially so in view of Kennedy's campaign promises.

Too, some oil people pointed out that oil might very well gain, rather

than lose, by a thorough study of the nation's fuel resources and problems. The important thing, they said, was that the study be a fair and impartial one.

At any rate, last week's action by the oil association leaders has obviously now committed the industry to support of such a study.

New Gas Tax Urged

. . . by Eisenhower in his final budget message.

HIGHER GASOLINE and aviation-fuel taxes were proposed by outgoing President Eisenhower in the annual budget he submitted to Congress last week.

Eisenhower's proposals are not binding, of course. President Kennedy is expected to present his own budget views to Congress.

Even so, Eisenhower's program will carry weight with members of his own party in Congress and may win support from some conservative Democrats.

On oil and oil-related issues, these are the Eisenhower proposals:

. . . **Increase the gasoline tax** to 4½ cents, instead of letting the federal tax drop back to 3 cents at the beginning of the new fiscal year July 1. Continue the 4½-cent tax through 1972.

. . . **Stop planned "diversion"** of automotive taxes from the general fund to the highway trust fund. This "diversion" is scheduled to start with the new fiscal year.

. . . **Increase avgas taxes** from 2 cents to 4½ cents a gallon and apply the 4½-cent rate to jet fuels, which carry no federal tax now. Eisenhower thinks the avgas taxes should go to the general fund.

Eisenhower also advised Congress to provide $15 million in the 1962 fiscal year to develop the helium-recovery program. This would be in addition to supplemental borrowing authority of $12 million for the 1961 fiscal year.

Other Eisenhower suggestions:

. . . **Transfer** administration of the petroleum reserves from the Navy to Interior.

. . . **Establish** a Department of Transportation to bring together at cabinet level "the presently fragmented functions regarding transportation activities."

watching WASHINGTON

Clyde La Motte

- **Kennedy team looks for advice on oil problems . . .**

OIL POLICIES of the new administration will be slow in taking shape.

Top officials are aware of the importance of oil's role, but are handicapped by a lack of Kennedy team members who know the oil score.

Emphasis now is on finding qualified advisers to help the administration with oil problems. For the most part, the administration would like to have new faces, rather than depending on holdovers from the Eisenhower era. That means a shakeup far down into the ranks.

But thus far the selection of key oil officials has been slow.

Note, for example, that the post of assistant secretary for mineral resources was the last to be filled at Interior Department. This is an important post for oil because neither Interior Secretary Stewart L. Udall nor his under secretary, James Carr, has any oil background nor any real desire to wrestle with oil problems.

The final outcome may well hinge on whom the administration turns to outside the Government for its oil advice. Up to now, the chief adviser on personnel for oil-related posts has been Oscar Chapman, former Secretary of Interior. The Chapman influence will be noticeable on oil policies, too, at least in the early days of the new administration.

- **Thus far, most oil advice is from non-oil sources . . .**

AT THE MOMENT, much of the shape of the administration's oil pattern is resulting from pressures outside the industry.

For instance, coal's voice is being heard on fuels policy and related problems such as industrial use of natural gas.

And New England industrialists have made Kennedy aware of the residual fuel oil situation in their region.

The impact of such consumer-group influence will be particularly evident in such areas as natural-gas regulation. And there will be more agitation by these groups for price investigations when the cost of anything they have to buy goes up.

The net result: There will be a tendency to consider oil guilty until it has proved itself innocent.

- **Task-group reports may carry little real weight . . .**

DON'T BE overly alarmed by the flood of reports being made by various task groups that have been busy making studies and recommendations for the new President.

For one thing, the reports naturally tend to overstate a given case since the authors know that not all of their proposals will be adopted.

And note that President Kennedy has been careful not to put any special stamp of approval on the task-group recommendations. Thus he has committed himself in only a few instances. For the rest, he has indicated that the reports will serve primarily as a source of information and a preliminary guide.

Finally, most of the programs advocated in these task-group reports would require congressional action. Congress will move slowly, deliberately, on most of these issues.

By the time some of these programs have been exposed to closer scrutiny by the administration and subjected to pressure groups and congressional hearings, they will scarcely be recognizable.

Highway-Cost Report Takes Poke at Truckers

• Commerce Department study argues that big vehicles should pay more toward road-building. It will be up to Congress to decide whether this is a good way to raise extra money for highway projects. Rest of report is vague.

HEAVY TRUCKS and trailer-truck combinations may have to foot a larger share of highway-construction costs if the findings of a Commerce Department study are put into effect.

"There is definite indication that the heavier trucks and combinations should be paying considerably more than they do now," the department said in a report to Congress last week.

This is one of the few clear-cut points in the bulky report on the 4½-year study of highway cost allocations.

One Commerce breakdown estimated the contribution to the highway fund in 1964 for a diesel-burning, 55,000-lb. tractor - semitrailer would be $613 at existing tax rates.

But Commerce figures the required payments of such a truck should range between $870 to $2,000 a year. Therefore, such a truck would fall short of paying its own way by $275 to almost $1,400 annually.

The department stresses these are preliminary estimates.

Who benefits? . . . One major part of the study covers the benefits of a highway program to nonhighway users.

It notes that landowners along a highway right of way might benefit considerably, particularly if the use of the land is upgraded.

With qualifications, Commerce indicates that approximately 8% of the tax burden should be assigned to revenue sources other than taxes on motor-vehicle users.

It does not, however, suggest nonhighway sources.

Who pays? . . . The Commerce report also points out that not all revenues of the highway trust fund are derived from use of highways by motor vehicles.

As an example it cites the excise taxes paid by the Department of Defense in connection with military vehicles not used on highways.

The report said other payments to the trust fund come from taxes on aircraft and from industrial, marine and other nonhighway users of motor fuels.

In all, it estimates that about $60 million will be paid into the trust fund in 1964 by nonhighway users.

This is largely offset by the extra costs to highway building that do not benefit the normal highway user. Such costs include overhead clearances of bridges for military vehicle purposes, and navigational - clearance facilities like drawbridges.

On the whole, the report leaves more questions unanswered than it attempts to answer.

What it boils down to, as the authors of the report concede, is that the problem of raising revenues for highway purposes is a policy matter the Government must decide.

That means the new administration and Congress will have to wrestle with the problem of where to tax to raise the needed money to build the roads.

Resid-Import Rules Relaxed

• Presidential amendment allows certain newcomers in District 1 to apply for quotas. Sellers will benefit.

THE DOOR has been opened, finally, for newcomers to get quotas for importing residual fuel oil into District 1.

In one of the last acts of the outgoing administration, President Eisenhower signed an amendment to the original proclamation governing imports to permit Interior to grant quotas to companies who had no history of residual fuel imports in the base year of 1957.

It will work like this: Residual fuel oil sellers in District 1 who have a record of deep-water terminal throughput—or who develop such a record—will be eligible for a quota.

Companies with a record of residual fuel imports during 1957 will continue to be eligible on that basis. They may choose, however, to switch to the terminal input basis in order to obtain a higher quota.

Under regulations being put into effect by Interior, established importers will get a quota of 85% of the ratio of their 1957 imports.

Because of the decline in domestic output of resid and the corresponding increase in imports, however, this 85% ratio may mean that a given historical importer will be permitted to bring in as much, or even more, than he did in 1959.

The remaining 15% will go to newcomers. This figure, too, is a ratio and the expected net effect is that newcomers will get an actual quota that will be from 20 to 30% of their terminal throughput during the base period.

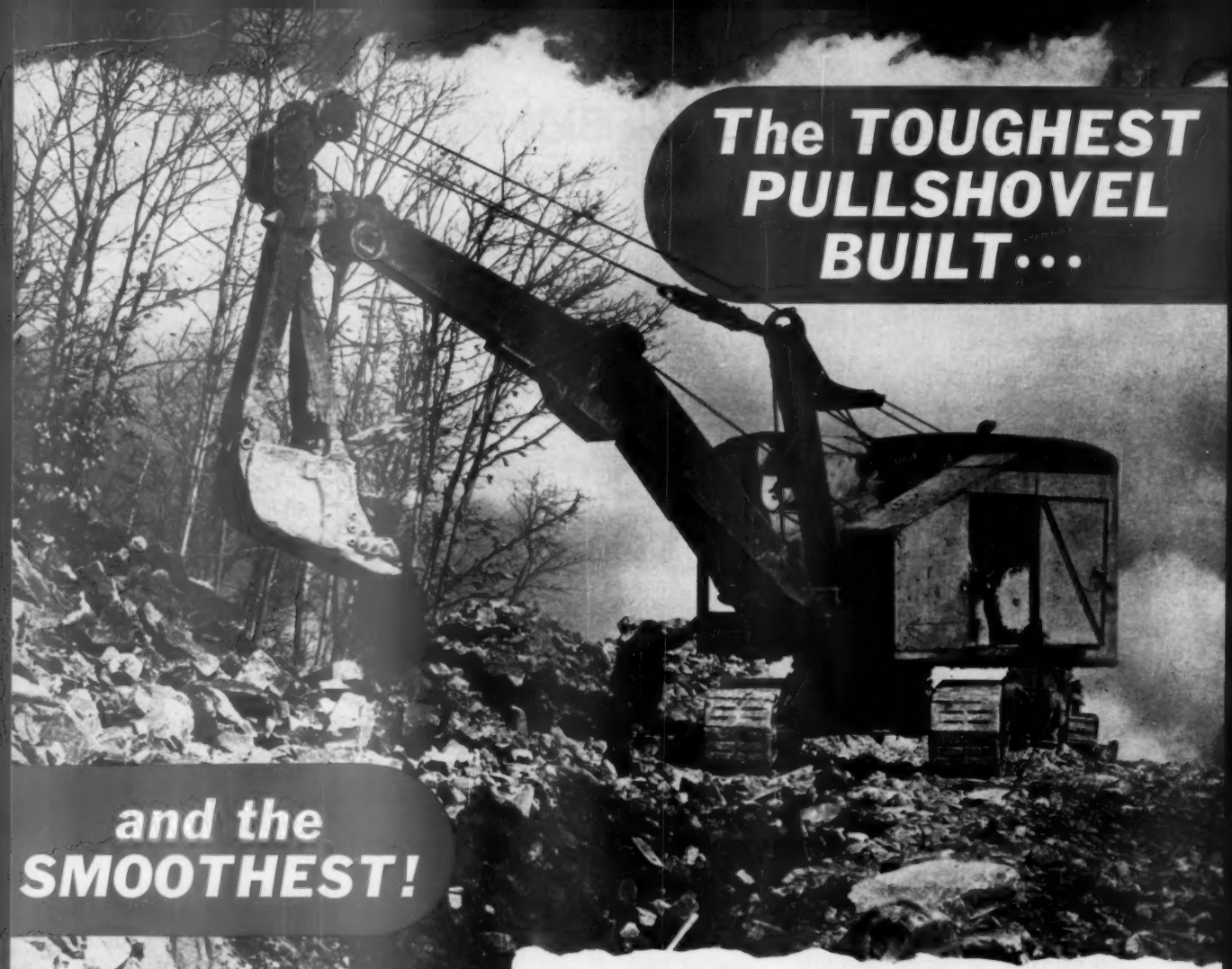
The base period will be the quarter ending 6 months prior to the start of a new allocation period.

Last week's action also clarified other points for newcomers.

It's specified that when resid is delivered to a large consumer, such as a utility or the federal government, the company retains the quota provided it makes the delivery and it owns the oil at the time of delivery.

The purpose of this is to put the quotas in the hands of those actually in the business of selling residual fuel oil.

Also, the new rules being adopted specify that a company can become eligible for a quota if the imported oil is placed at the deep-water terminal in its account.



The TOUGHEST PULLSHOVEL BUILT...

and the SMOOTHEST!

PIPE LINE work calls for the best in equipment. You are never sure every foot of the way, exactly what you are going to hit. Water crossings often make rough going. Road crossings must be handled rapidly. Rock digging calls for real digging ability.

Northwest Pullshovels are built for depth, reach, and ability in tough digging. Pictured is a Model 25, ¾ yard Northwest, the workhorse of the pipe lines in a tough rock cut. It will bottom out at 17 feet with an 8 foot floor and gives a maximum reach of 31 feet 6 inches.

Here is the power and the weight to handle hard, heavy, digging. No auxiliary equipment is needed to hold a Northwest Pullshovel dipper down in the cut properly.

This is the kind of a job that brings out the value of the Northwest Feather-Touch Clutch Control. The Feather-Touch Clutch Control brings greater ease to operation. It gives the true "feel" of the load. There is no substitute for the feel of the load in probing out a buried ledge of rock, "feeling" for utilities or working around men.

Large Swing Clutches increase the accuracy in spotting loads and digging. All Northwest Swing Clutches are Uniform Pressure Swing Clutches. They are smooth in action, positively controlled. They make possible the clean trimming of the sides of the trench or the swift accurate spotting of the dipper over the hauling units.

These are just a part of the many Northwest advantages that get the job done—just a few of the things that save time and make money. There is nothing finer in a Pullshovel.

NORTHWEST ENGINEERING COMPANY
1513 Field Bldg., 135 South LaSalle Street, Chicago 3, Illinois

Shell Leads Tule Creek Bids

- Company pays $350 an acre for one of tracts offered in Montana land sale. Murphy's "mystery" well is nearby.

MONTANA'S mystery field at Tule Creek, Roosevelt County, last week sparked one of the liveliest land sales of recent months.

Reason for the "mystery" tag is the almost-total lack of information on wells, both productive and dry, that have been drilled in the area since the discovery last October.

Operators withheld data pending the sale of Indian lands surrounding the discovery well.

Shell Oil Co. stole the show when bids were opened on 32,556 acres out of the 40,101 that had been offered. Shell's top bid was $350.35 per acre for Tract 60 in Secs. 23, 25, and 26 of Township 30 north, Range 47 east.

Second highest bidder on this tract, which lies 2¼ miles southwest of the discovery, was Pan American Petroleum Corp. with $137.74 per acre.

Average bonus offered for the Tule Creek lands was $40.48 per acre. Proceeds to the Fort Peck Indian Agency totaled $1,318,055.

Winning bids ranged from a low of $5.01 on Tract 99 to Shell's high bid on Tract 60. Of 26 tracts that went for more than $50 per acre, Shell took 10 with bids ranging to a low of $67.46 for Tract 168.

Other active bidders included Humble, British American, California Co., Pan American, Murphy Corp., Mule Creek Oil, Gulf, Placid, Texaco, Phillips, McAlester Fuel, Eason, Skelly, Husky, Amerada, and Hunt.

All of these companies were successful bidders on one or more of the 197 tracts offered. The 10-year leases included 125 unrestricted, individually owned trust tracts and 72 tribal-land tracts, ranging from 38.64 acres to 440 acres. Terms of the sale called for 25% cash with remainder to be paid along with rentals 30 days after approval.

The field that sparked the bids is still an unknown quantity. So far, only one commercial producer has been finished. Another seems assured. A third is in the pretesting stage, having set production casing.

Murphy Corp. discovered the field with its 1 Sletvold in Sec. 18-30n-48e; it flowed 476 bbl. of oil per day from Nisku-Devonian at 7,660-92 ft.

The first offset, less than a mile east, was a duster and caused a lot of head-scratching among operators who had plunged into the field after the initial strike.

Second indicated producer is Placid Oil Co. 1 Lough in Sec. 13-30n-47e, 2½ miles northwest of the discovery. Even this operation is still tight, but rumor has it comparable to the 1 Sletvold. Placid has set production casing at 2 Lough south of the No. 1 and in the same section.

On the debit side, besides the first dry offset, there have been at least three confirmed dry holes and two that are generally written off despite their tight status. The failures lie south and west of the Murphy discovery.

There are six drilling wells and eight announced locations not yet spudded.

Bids at last week's sale might have been much higher, possibly $1,500 per acre or more, if this string of dry holes hadn't come along just before the sale.

There is small chance that more information on active wells in the area will be released soon because a second sale will be held February 14 on more than 41,000 acres of tribal and allotted Indian lands of the Fort Peck Reservation.

The new offering is entirely in Roosevelt County, most of it within the Tule Creek nucleus.

Bidding results are subject to final audit by the Indian agency.

Rival LPG Line Moves Ahead

- New company's ready to let first contracts on project that would vie with Transco's bid to serve Southeast.

PROPONENTS of a second liquefied-petroleum-gas line from Texas to the southeastern U. S. are going ahead with plans for construction.

Members of the group, Warren Petroleum Corp., Phillips Petroleum Co., Union Texas Natural Gas Co., and Tuloma Gas Products Co. last week organized Dixie LPG Pipeline Co. with the avowed purpose of building a line from Mont Belvieu, Tex., to Raleigh, N. C.

Spokesmen for the group said flatly that the line will be built and that contracts for design and engineering will be let this week.

The disclosure came soon after Trans-Southern Pipeline Corp., first to chart such a line, announced it had completed its second river crossing and had revised its original routing (OGJ, Jan. 16, p. 60).

The rival routes would be almost identical. Both would start at Mont Belvieu. Trans-Southern's would terminate at Sanford, N. C., and Dixie's at Raleigh. These cities are about 40 miles apart. Trans-Southern, a subsidiary of Transcontinental Gas Pipe Line Corp., originally planned to end its system at Danville, Va.

Dixie spokesmen said their company hopes to complete acquisition of right of way and start construction in the first quarter of this year. Trans-Southern says it will start laying pipe in April.

Since there is too little business for two lines, the rivalry takes on the aspects of a high-stakes poker game.

Both companies have impressive hole-cards. Trans-Southern, whose route would parallel Transco's gas line from Eunice, La., to a point near Danville, already has much of the needed right of way. Dixie's backers are major suppliers and marketers of LPG, giving the company an assured supply and assured outlets.

Dixie spokesmen declined to name companies that will share ownership of its line. They said that the division of ownership has not yet been completed.

British Columbia Oil Wins Vancouver Market

PREMIER W. A. C. Bennett has apparently won his battle to boost British Columbia oil development by bringing northern B. C. crude into the Vancouver market.

After conferences with the presidents of the four refining companies in Vancouver, Premier Bennett is satisfied that the refiners will cooperate. They have agreed, his office said last week, to take "whatever amounts of B. C. crude can be delivered competitively."

Within a year this volume could amount to 20,000 bbl. daily of the present Vancouver market of 70,000 to 75,000 bbl. daily. It's now supplied entirely by Alberta crude, which apparently will have to move over to make room for B. C. production.

Pipeline proposals . . . In response to Bennett's request, three pipeline companies last week submitted proposals for transporting northern B. C. oil to Vancouver.

All three would connect with Trans Mountain Oil Pipe Line Co.'s Edmonton - to - Washington trunk line which now brings Alberta crude into Vancouver. A construction permit is to be issued by January 31 to one of these companies:

. . . Trans-Prairie Pipelines, Ltd., Edmonton, which proposes a line from Dawson Creek, B. C., 250 miles southward to a connection at the Albreda, B. C., pump station of Trans Mountain close to the Alberta border.

. . . Peace River Oil Pipe Line Co., Ltd., Calgary, which wants to lay an 8-in. line connecting with Trans Mountain at the Edson station in Alberta. Peace River's proposal received government approval last year but was dropped by the company which claimed restrictions imposed by the province made it impossible to finance.

. . . Westcoast Transmission Co., Ltd., which would build a line paralleling its existing 30-in. for about 375 miles from the Fort St. John-Dawson Creek area to the Kamloops, B. C., station of Trans Mountain.

Trans Prairie is now building a $10,000,000 crude - gathering system, the first in the province. It will connect Beatton River, Doig River, Boundary Lake, and Milligan Creek fields to Fort St. John and Dawson Creek rail heads. The 8-in. main line will have capacity of 20,000 bbl. daily, and is to be completed in September.

Reserves, production . . . B. C.'s present output of about 2,500 bbl. daily is trucked to market.

Although the present producing rate is quite small, proved reserves have been estimated at more than 100 million barrels. Development has been slow for lack of a market, a situation which Premier Bennett has sought to correct.

Agreement of refiners to take B. C. crude, and authorization of a pipeline to transport it, will spur drilling among the 27 producing companies which are being connected to the Trans-Prairie gathering system.

Additional producing capacity will be developed during the year and reserves will be increased in the process.

Market . . . Bennett, dissatisfied with the rate of oil development, has applied pressure to open the Vancouver market in order to produce shut-in wells and speed exploration.

As a government spokesman explained it, "we have a strong conviction that there is a much greater volume of oil up there, and this is the means of stimulating the search for it."

The Vancouver area has four refineries with combined capacity of 89,000 bbl. daily. Demand in the area has been running at 70,000 to 75,000 bbl. daily. Nominations of Alberta crude for delivery through Trans Mountain to Vancouver during January totaled 73,000 bbl. daily.

PIPELINE BRIEFS . . .

Loop lines totaling 346 miles will be built in 1961 by Natural Gas Pipeline Co. of America if FPC approves. The company plans 257 miles of 30-in. lines at a cost of $28,560,000 and 89 miles at a cost of $23,750,000. The loops would increase Natural's capacity by 160 million cubic feet per day.

Over 1,200 miles of laterals will be built by Northern Natural Gas Co. this year as the company extends service to 103 communities in Iowa, 43 in Minnesota, 14 in South Dakota, 4 in Nebraska and 1 in Illinois.

Looping planned by Columbia Gulf Transmission this year involves 96.9 miles of 30-in. main line loops. The looping will be in Kentucky, Tennessee, Mississippi and Louisiana and 28.9 miles of 12-in. laterals will be laid in Louisiana.

A 15% increase in deliveries was reported by Trans Mountain Oil Pipe Line Co. for 1960. Deliveries in 1960 averaged 113,143 bbl. per day against 98,239 bbl. in 1959. Deliveries are expected to average 128,000 bbl. daily this month.

A new 30-in. gas line across Louisiana is proposed by United Gas Pipe Line. The 217-mile line would extend from a point south of Lafayette to Monroe. The company estimates the line can be completed 8 months after FPC approval.

Lower tariffs, down from ½ to 3½ cents per barrel, will be in effect for Southeast Saskatchewan fields after February 1. Reductions, due to greater volume of traffic, were made by Producers Pipelines Ltd. and Westspur Pipe Line Co. Fields affected are Midale, Viewfield, Frobisher, Alameda, Cantal, Hastings, Glen Ewen, Arlington, South Ingolsby, Parkman and East Parkman.

Leaching of a 150,000-bbl. cavity in a Matagorda County, Texas, salt dome for storage of propane-butane mix is planned by Seadrift Pipe Line.

Production Will Outstrip Demand in 1961

THIS YEAR is going to be a little better for producers than the expected increase in demand would indicate.

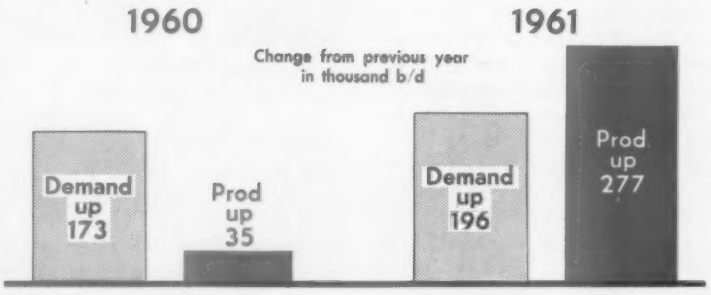
Last year total demand climbed by a respectable 173,000 bbl. daily. But total production inched up only a meager 35,000 bbl. daily.

The industry drew so much of its requirements from storage it didn't need much additional output. Crude-oil production, in fact, dropped 22,000 bbl. daily below the 1959 level.

This year oil producers will get to meet the demand increase, and they'll also be called on to replace part of the crude taken out of storage in 1960. Here's how things look now:

... **Total demand** should rise 196,000 bbl. daily over 1960. The Journal estimates 1961 demand at 10,031,000 bbl. daily compared with 9,835,000 bbl. daily in 1960.

... **Total production** will rise 277,000 bbl. daily—and 240,000 bbl. of this will be crude oil. The Journal estimates 1961 crude production at 7,272,000 bbl. daily in 1961 compared with 7,032,000 in 1960.



Inventory picture . . . Refiners and suppliers in 1960 met 59,000 bbl. daily of demand out of storage.

This involved a 52,000-bbl. daily reduction in crude stocks and a 7,000-bbl. daily cut in product inventories.

There is every reason to believe that suppliers will reverse this trend in 1961. Unless prevented by restricted allowables, producers and refiners will build crude inventories to somewhere near 250,000,000 bbl., a nearly normal figure.

This will call for putting about 35,000 bbl. of crude daily into storage to replace much of that taken from tanks in 1960.

Product stocks, however, are expected to drop about 11,000 bbl. daily, about 4,000 bbl. more than in 1960. This would reduce the net gain in total stocks this year to 24,000 bbl. daily.

This 24,000-bbl. net increase in stocks, following a year in which stocks dropped 59,000 bbl. daily, will mean that producers must provide 83,000 bbl. daily more than last year to permit this adjustment in inventories.

Supply outlook . . . Required petroleum supply in 1961 thus should total 10,055,000 bbl. daily to meet demand and rebuild inventories.

This is a gain of 279,000 bbl. daily over the year before. However, imports are expected to gain 2,000 bbl. daily to 1,810,000 bbl. That will leave the supply to be met by domestic production at 8,245,000 bbl. daily or a gain of 277,000 bbl.

Gas liquids, however, will pick up 37,000 bbl. daily of this gain, leaving crude producers with a possible gain of 240,000 bbl. daily.

Majors Told to Learn from Chain Stations

MAJOR-BRAND marketers could well afford to take lessons from enterprising private-brand service-station dealers and chain operators in many areas of the country.

If they don't, the majors can expect to lose an increasing share of the market to the smart private-brand crowd.

This warning was issued last week by George D. McDaniel, head of distributor-dealer relations for Mobil Oil Co., before the Kentucky Petroleum Marketers Association in Louisville.

Private-brand growth . . . "Some of these local-brand outlets are selling two, three, and even four times as much gasoline as major-brand stations in the same areas." McDaniel said.

This private-brand ascendency, in McDaniel's view, is an "outstanding fact about the present state of oil marketing."

He thinks the situation has developed largely because major suppliers and jobbers failed to take as much advantage of improved distribution as private branders.

"The private-brand dealer's ace in the hole was that he could buy gasoline at terminal prices," McDaniel said, "and that he had eliminated the need for small intermediate bulk plants."

Branded dealers in today's competitive market can't expect a return to margins of 6 to 8 cents a gallon, he said.

What must a major-brand marketer do to stay competitive?

McDaniel advises him to:

... **Cut costs** without reducing effectiveness.

... **Have the flexibility** to drop uneconomical service stations and develop new ones where customers most need them.

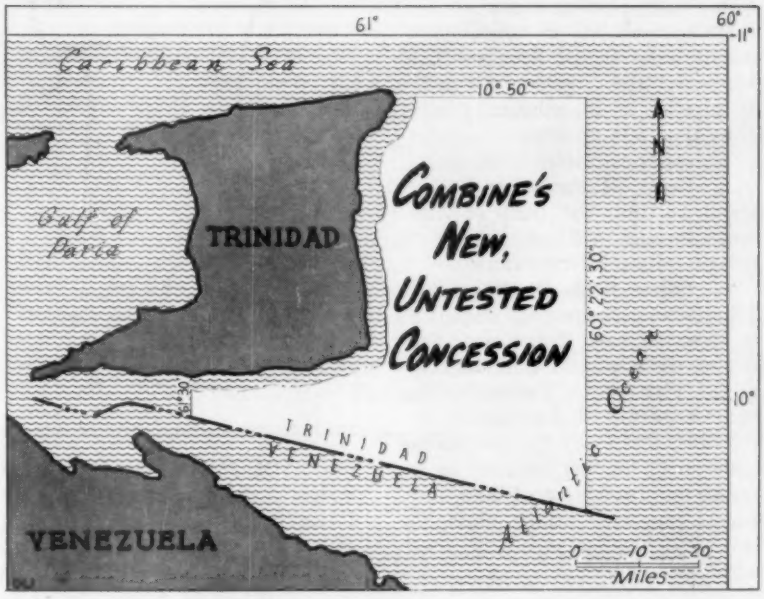
... **Have stations** with average volume of 250,000 gal. a year to attract the most competent dealers.

... **Consider charging off** old investments (uneconomical bulk plants, small tank trucks, small storage tanks at service stations).

... **Follow the road** of the private brander, if local conditions dictate, by delivering products from the supplier's terminal directly to his service stations.

Huge Offshore Block Awarded by Trinidad

• Three-company group gets rights to untested tract on a 50-50 profit basis.



A THREE-COMPANY group has won exploration rights on 2 million acres of untested offshore areas off East and Southeast Trinidad.

Pan American International (Indiana Standard), Pure Oil, and Sun Oil each will have one-third interest in the concession, which covers about 3,120 square miles.

This is an area 60% larger than the island of Trinidad itself. Pan American will be the operator.

Preliminary exploration work is expected to start in May. Pan American is now making plans to transfer geological and geophysical personnel from other operations to Trinidad.

The offshore rights lie beyond the 3-mile limit, which is the boundary of existing offshore licenses.

The southern boundary is formed by the border between Venezuela and Trinidad.

Water depths vary greatly in the prospecting area. They are generally in the range between 50 and 250 ft., and nowhere exceed 600 ft.

Concession terms . . . The three-company group has a minimum work obligation in the first year of about $500,000. The obligation thereafter during the life of the licenses is about $1 million. This could be reduced in case of early surrender of some of the acreage.

No bonus was paid for the rights.

The exploration license runs for 10 years, with a 5-year extension possible if commercial production is found in the meantime. Twenty-five per cent must be surrendered after 10 years, and another 25 per cent after the 5-year extension.

If a commercial discovery is made, the group may take out any number of exploitation blocks around the find. These are 5,000-acre tracts with a life of 30 years.

Under a sliding scale of rental, the exploitation tracts will cost 10 cents (British West Indies currency) per acre the first year. The rental will rise in steps to a maximum of $1.80 (BWI) per acre annually after 10 years. This is roughly a range from 6 cents to $1.08 per acre annually in U. S. currency.

The agreement on profit split may be a sign of underlying strength for the 50-50 profit division in foreign production. The government, which now in effect takes 40% of the profits, plans to pass a law within a few months providing for a 50-50 profit split. Pan American, Sun, and Pure have agreed to go along with the provisions of the forthcoming law.

This is the second major exploration agreement in a matter of weeks in which the 50-50 split has been agreed on, despite a trend toward a larger slice for governments. Offshore rights also were covered in the other agreement, Shell's deal for a concession off Kuwait.

A 12½% royalty also will be paid to Trinidad.

Until now, offshore drilling in Trinidad-controlled waters has been confined to the Gulf of Paria, which lies between Venezuela and Trinidad. Production of several thousand barrels daily from Soldado offshore field and from offshore extensions of onshore structures makes an important contribution to the island's 121,000 bbl. daily total production.

No drainage . . . Venezuela has closely watched operations on the Trinidad side of the Gulf of Paria, and has decided no drainage of Venezuelan oil pools is taking place.

Dr. Juan Pablo Perez Alfonzo spiked rumors that Venezuelan oil was seeping over the boundary. He said dry holes have been drilled between Paria Operations, Inc., producing wells in the gulf and the boundary, and that the nearest Trinidad production is almost 6 miles from the abandoned wells.

Paria Operations has suspended drilling operations after 20 wells, of which 6 were producers.

France Protects Algerian Stakes With

THE FRENCH bet heavily on Algerian oil and won.

Now facing a politically uncertain future in the nationalistic country that may demand independence, the French are hedging their bet with a hefty pipeline raise.

France will link its two big producing areas in the Sahara—Hassi Messaoud and Edjele—with a 30-in. pipeline at an estimated cost of more than $35 million.

The present picture is this:

. . . Hassi Messaoud is moving about 160,000 bbl. daily of crude north through a 24-in. pipeline to Bougie on the Mediterranean.

. . . Edjele fields in the eastern Sahara have stepped up shipments to about the same figure since September when a 24-in. line was completed through Tunisia to La Skhirra on the Mediterranean.

While the French are adding additional pumping capacity to increase the throughput of both lines, French pipelayers will be joining the two producing areas on the south with 30-in. pipe.

The beginning . . . The beginning of this 30-in. line is already under way with a 330-mile line to link Hassi Messaoud to the newly found field at Ohanet, north and slightly west of Edjele.

A quick glance at the map would make it seem logical to funnel Ohanet production into the Edjele pipeline system. Instead, the French plan to move it more than 300 miles northwest to the Hassi Messaoud system.

This pipeline will be built in two sections. The first 140 miles will be laid by SOCOMAN, a subsidiary of the giant Cie. De Pont a Mousson. SOCOMAN just last week bought a double-jointing unit from Crose-Perrault Equipment Co., Tulsa, for use on the project. SOCOMAN expects to complete its part of the giant project by June.

The remainder of the line from Hassi Messaoud to Ohanet will be built by Groupement des Societies Entrepose et Parisienne Pour L'Industrie Electrique en Vue de L'Etude et La Pose de Pipelines (GREP).

Eventually the line will be continued another 120 miles to Amenas, the southern terminal of a 24-in. line which serves the Edjele area.

The reasoning . . . At first blush the new project, which eventually will mean building more than 400 miles of big-inch line to join the two producing areas, defies all logic. It puts the large end of the funnel on the wrong end. It would string 30-in. pipe across a remote stretch of some of the worst desert in the world. And it would not give the Sahara additional oil outlets.

There are three reasons for the French decision to build the "long" line rather than a short one for Ohanet:

. . . Pumping equipment would have been necessary to move the Ohanet production the 70 miles due east to tap the Edjele pipeline.

. . . The long line will flow from Ohanet to Hassi Messaoud by gravity.

. . . This pipeline would serve the basis for the flexibility link which the French want connecting the major producing areas so far found in the Sahara. It would provide a partial outlet for both fields if political troubles should prevent either pipeline from operating.

Ohanet field . . . The discovery of Ohanet field, in which Mobil International has a 25% interest, gave the French just the added push needed to build the connecting line.

The discovery, which flowed 1,900 bbl. daily, was made last April by Cie. D'Exploration Petroliere (CEP), French government controlled company, a short time after the American company bought an interest in the operation (OGJ, May 2, p. 91). Since that time, four more wells have been completed in the field. Each tested from 1,500 to 2,000 bbl. daily. A sixth well is being completed now.

The French first planned to link the new field to the Edjele pipeline. But, it now appears that the complex of small fields in the Edjele

Offshore Kuwait Drilling Set by Shell

THE FIRST TEST of a new 1,500-sq.-mile offshore concession in the Persian Gulf off Kuwait will be drilled early next year.

Royal Dutch-Shell, which walked away with the biggest oil exploration prize of the decade in acquiring the oil rights, will waste no time in trying to make them pay off.

The award to Shell, in competition with seven other companies, was revealed last month (OGJ. Dec. 5. 1960. p. 91). The agreement was signed formally last week by the Shaikh of Kuwait and F. J. Stephens, a managing director of the Royal Dutch-Shell group.

Seismic work on the underwater region will begin almost immediately. Shell hopes to have it completed before July.

Another 6 or 7 months will be taken for study and interpretation of the seismic work and then drilling will begin.

A new company, Kuwait Shell Petroleum Co., will handle all operations under the new 45-year concession.

New Pipeline

area will produce more oil than the 24-in. line will move. It also appears that bigger Hassi Messaoud field may not produce enough—right away, at least—to keep its own line operating at capacity.

The flexibility . . . Once the two producing areas are linked and Ohanet crude is moving into the Hassi Messaoud system, the French will have the option of moving oil from either area in either direction in case of an emergency.

Such an emergency could well arise if efforts to settle the political future of Algeria are not successful. If, in the future, the French should lose the Hassi Messaoud-Bougie pipeline for any reason, they could begin looping the Edjele-La Skhirra line and at least have a partial outlet for crude from both regions.

New Libyan Strike May Be Big Producer

A "SIGNIFICANT" new discovery in northern Libya looks like a 5,000-bbl.-daily well.

Esso Sirte is confident that Raguba 1 on Block 20 can be increased to this level by opening more of a 220-ft. pay section and by acidation. The gas and oil pay lies below 5,280 ft.

The well is in the southeastern portion of the block, about 80 miles from the Mediterranean Coast. It is in a line between Esso Libya's Zelten field and Oasis Oil's Dahra field, approximately 50 miles northwest of Zelten and 75 miles southeast of Dahra.

Esso Sirte is operator on the concession which is owned jointly with Libyan American Oil Co. and W. R. Grace & Co.

Initial tests on a 40-ft. perforation between 5,440-5,480 ft. flowed 40.5°-gravity crude at 494 bbl. daily through a ¼-in choke. The well tests 2,250 bbl. daily on a ½-in. choke. This is better than indicated in preliminary reports (OGJ, Jan. 16, p. 46).

Esso has moved a second rig into the area, and two delineation wells are now drilling.

The Reguba find came in a year after Esso Sirte acquired an undivided half interest in Tripolitania's Concessions 16 and 17 and Cyrenaica's Concession 20 from Libyan American, a wholly-owned subsidiary of Texas Gulf Producing Co., and W. R. Grace. Mabruk field, now under commercial development is on Block 17.

Argentina Okays New Petrochemical Complex

A $70-MILLION petrochemical complex at San Lorenzo, Argentina, has been officially approved by the Argentine Government after long negotiation.

The complex, first of the kind in Argentina, will be financed and built by Petroquimica Argentina SA (PASA), owned by five U. S. firms. Cities Service, Continental Oil, and U. S. Rubber each will hold a 24% interest. Fish International will hold 15% and Witco Chemical 13.

The parent companies were told last week that approval of the project had been granted in a decree signed by President Arturo Frondizi.

W. F. Brown, chief negotiator for the group, said the approval climaxed nearly 2 years of negotiation with government agencies, particularly the Ministry of Economics (OGJ, Sept. 5, 1960, p. 108).

Work will start immediately on nine inter-related plants, with units scheduled for completion at intervals ranging from 18 months to 36 months.

Facilities will include two synthetic-rubber plants, a catalytic reformer and an alkylation unit, and three chemical units to make chemical intermediates, butadiene and styrene.

Design capacity of the project will be 32,000 tons per year of butadiene and 14,000 tons of styrene for use in making synthetic rubber and plastics; 45,000 tons of synthetic rubber (35,000 tons of SBR and 10,000 tons of cis-polybutadiene); 11,500 tons of chemical intermediates; 850 bbl. daily of benzene for chemical manufacturing; 8,800 bbl. daily of gasoline; and 1,300 bbl. daily of alkylate for use primarily as aviation fuel.

Fish International will build the complex.

Feedstocks of distillate, propane, and carbon black will be drawn largely from YPF's oil and gas fields in the Campo Duran area of northern Argentina. Some feedstocks also will be taken from YPF's nearby San Lorenzo refinery.

Supplies will be taken from a new 920-mile 12-in. products pipeline and a new 22 and 24-in. natural-gas line from northern Argentina.

The gas line extends another 250 miles southeastward to Buenos Aires.

Both lines were built by Fish.

PASA will operate its reformer for YPF on a negotiated basis. It will supply the government agency 7,950 bbl. of high-quality gasoline, 1,165 bbl. of aviation gasoline, and 480 bbl. of propane daily.

The project will be financed by the five parent companies and a group of private investors in the U. S. and western Europe. Long-range plans call for allowing local financial interests to participate.

The project will save the country $25 million per year in foreign exchange.

Another project aimed at manufacturing SBR synthetic rubber in Argentina has been dropped. Texas Butadiene & Chemical Corp. has announced it will not build proposed synthetic-rubber and butadiene plants at Puerto de Seado.

Several factors contributed to Texas Butadiene's withdrawal. The major one seemed to be a difficulty in raising the $36 million required to finance the project.

The company also cited technical reasons.

OPEC Huddles on Market, Price Issues

• Caracas talks were held behind closed doors, but delegates were agreed on one thing before they went in: Stable markets should be set up in order to wring maximum income from oil production. Their problem was how to do this.

TWENTY-SEVEN MEN, with varying degrees of oil experience, sat behind closed doors in Venezuela's white palace at Caracas last week and tried to do something that the oil industry would not, or could not, do — divide the world's oil markets.

The occasion was the first working meeting of what has been critically called the "producers' cartel," named formally at Baghdad last September as the Organization of Petroleum Exporting Countries.

The 27 represent Venezuela, Saudi Arabia, Iraq, Kuwait, Iran, and Qatar. They proudly claim they control 93% of world exports.

The key to last week's meeting lies in that word "control."

None of the 27 who met at Caracas feels that his country has enough control over the oil that is produced by the world's privately financed and operated oil companies.

None of the oil companies was invited to attend the meeting. They, in fact, are the indirect target at which the 27 are shooting.

Each of the countries represented at the Caracas meeting is vitally dependent on oil. Without the income they receive from oil production, each would collapse in an economic shambles.

All feel that the vagaries of today's supply-and-demand oil market with its fluctuating prices is dangerous to the economic base of their countries. All want to create stable oil markets with uniformly high prices and resulting high income, in spite of the oversupply situation.

President Romulo Betancourt of Venezuela echoed the theme of OPEC when he welcomed the delegates at Miraflores Palace.

Oil-producing nations, he said, "cannot sell at bargain prices a wealth which is every day more valuable." He also called upon OPEC to stand firm for oil prices prevailing before last August's reductions of from 4 to 14 cents a barrel.

Price issue on agenda . . . After the presidential greeting, the delegates quickly accepted Qatar as the sixth official member of OPEC and then retired behind police-guarded doors to try and weld an organization to achieve its aims.

High on the preliminary agenda was a discussion of what action each of the members has taken to pressure companies operating in their various countries to restore posted prices to pre-August levels.

Mohammed Salman, Iraq's newly appointed oil minister, said in Caracas before the meeting opened that all companies operating in the Middle East had been informed that the producing countries would "not accept the price cut." He added that there has been no reply from the companies.

Shaikh Abdullah Tariki, Saudi Arabia's oil minister, put it more succinctly:

"We will compute our taxes based on prices before August 1960."

The token price cuts made by the companies merely reflected a weak market in which sales were being made at discounts much lower than the actual cut, but the move infuriated Arab oil leaders and prompted the formation of OPEC.

One of the new organization's platforms is that no private oil company will be allowed to cut oil prices without first consulting the government of the producing country.

There is no question that the delegates from the Middle East producing countries and Venezuela are united in their general aim to secure high and stable prices for their oil. It is very doubtful if they are as united on just how this could be done.

OPEC's top leaders, Salman, Tariki, and Perez Alfonzo, believe price stability will come only if production is controlled to meet worldwide demand.

Air of secrecy . . . What final pattern was decided last week at Caracas—if any pattern did emerge—won't be made public soon.

After first saying that a briefing of happenings would be released at the end of each meeting, Perez Alfonzo backed away from giving any information at all. He pointed out that any action taken at Caracas will have to be approved and ratified by the governments represented there. What OPEC decided to do will be revealed only after the governments act.

Oil Ministers Among Caracas Delegates

THE national delegations to the OPEC meeting ranged in size from Venezuela's lawyer-packed, nine-man delegation down to little Qatar's one-man representation.

Three of the delegates head oil ministries—Mohammed Salman of Iraq, Shaikh Abdullah Tariki of Saudi Arabia, and Dr. Juan Pablo Perez Alfonzo of Venezuela.

The delegations:

Venezuela—Perez Alfonzo, Dr. Manuel Egana, Dr. Manuel Perez Guerrero, Dr. Alfredo Tarre Murzi, Dr. Pedro Miguel Pareles, Dr. Enrique Tejera Paris, Dr. Eduardo Acosta Hermoso, Lt. Col. Victor Maldonado Michelena, and Dr. Eddi Morales Crespo.

Iran—Fuad Rouhani, F. Nafici, A. Ittehadieh, F. Najmabadi, and A. Jahanbegloo.

Iraq—Salman, Jamil Thabit, Abdul Munium Ali, Abdullah Sayab, Abdul-Aziz al Wattaribj, and Abdullah Ismail.

Kuwait—Ahmad al-Sayid Omar, and Faisal Mazidi.

Saudi Arabia—Tariki, Mohammed Joukhdar, Hishao Mazir, and Fadh Sidmeri.

Qatar—Dr. Hasan Kamil.

Here's Where Foreign Rigs Are Running

	Jan. 1961	June 1960	Dec. 1959
LATIN AMERICA			
Argentina	109	106	99
Bolivia	11	10	11
Brazil	55	48	42
Br. Honduras	1	....	1
Colombia	14	19	28
Chile	6	4	5
Costa Rica	1	1	....
Cuba	....	1	1
Dom. Rep.	1	1	1
Ecuador	3	3	4
Guatemala	....	1	3
Mexico	153	134	120
Peru	11	11	9
Puerto Rico	....	....	1
Trinidad	25	28	31
Venezuela	42	42	66
TOTAL	432	409	422
MIDDLE EAST			
Bahrain	1	....	....
Iran	14	16	10
Iraq	9	11	6
Israel	4	6	4
Jordan	....	....	1
Kuwait	3	2	3
Neutral Zone	6	6	5
Qatar	1	2	1
Saudi Arabia	2	3	4
South Arabia	2	2	3
Syria	2	2	2
Turkey	11	11	12
TOTAL	55	61	51
WESTERN EUROPE			
Austria	9	9	9
France	28	50	43
W. Germany	100	100	105
Greece	1	....	....
Italy	36	36	36
Netherlands	4	4	3
Spain	6	6	6
Switzerland	....	1	....
U. K.	5	4	5
TOTAL	189	210	207
AFRICA			
Algeria	42	53	40
Angola	3	3	3
Egypt	11	11	11
Senegal	2	3	2
Gabon	1	6	7
Gambia	1	1	....
Libya	38	32	24
Madagascar	1	2	1
Middle Congo	1	1	1
Morocco	1	1	3
Nigeria	6	5	9
Span. Sahara	1	....	....
Somalia	2	2	2
Kenya	1	....	....
Tunisia	1	1	1
TOTAL	112	121	104
ASIA-PACIFIC			
Australia	5	4	3
British Borneo	2	2	2
Burma	3	3	5
Formosa	1	1	1
India	11	6	5
Indonesia	15	15	15
Japan	15	15	15
New Guinea (inc. Papua)	1	1	2
New Zealand	2	1	....
Pakistan	3	5	5
Philippines	1	2	1
Timor	1	1	1
TOTAL	60	56	55
GRAND TOTAL	**848**	**857**	**839**

NOTE: Estimates are made where complete up-to-date reports are lacking.

Rotary Drilling Abroad Maintains High Pace

• Despite small changes, rig activity outside Canada and the U. S. remains near record. And the signs point to a continued expansion of operations.

THE JOURNAL TALLY of rotary drilling outside the U. S. and Canada shows that activity continues at a near-record level.

A January survey indicates 848 rigs are now operating—9 fewer than in June, but 9 more than in December 1959.

This may be a sign that despite fluctuations, the long-range postwar trend toward expansion in drilling continues. The number of rotaries in foreign areas has increased by some 395 in the past 10 years, and by 155 in the past 5 years.

In the U. S., 1,735 rigs were making hole early in January—25 fewer than in June. In Canada, the total was 161—only 4 fewer than in June, despite the arrival of the winter freeze.

This brings the grand total of active rotaries in the free world to 2,744.

New Guinea soon may be written off as exploration country. No drilling has been carried on for some time in Netherlands New Guinea, on the western side of the island, where declining crude output is down to 4,500 bbl. daily. In Papua, on the eastern side of the island, Iehi 1 wildcat was abandoned early this month. This may mark the end of a 24-year, $70-million exploration search by Stanvac, British Petroleum, and a local Australian firm, Oil Search.

The planned split of Stanvac by the parent companies, Jersey Standard and Socony Mobil, has put a crimp in the subsidiary's exploration programs. Stanvac has three rigs operating in Indonesia, and is participating in a test in Australia's Port Campbell area. But rigs in the Philippines, Pakistan, India, and Somalia are stacked.

In Pakistan, a joint Pakistan Petroleum-Sun Oil wildcat at Dasori is drilling ahead at 5,300 ft., halfway to its objective.

The test is in southeastern West Pakistan, in the vicinity of dry holes drilled by Stanvac and Pakistan Petroleum. The well is the country's sixty-fourth wildcat.

In East Pakistan, Shell is preparing a stepout to a gas discovery in the Sylhet area.

Libya, Algeria Gain . . . Activity is still on the increase in Libya and Algeria. Thirty-eight rigs are running in Libya, and Algeria has 42 in operation.

For the rest of Africa, the drilling picture shows only slight fluctuations.

Drilling operations rose in India, where 11 rigs were at work.

CLIMBING one of San Francisco's steep hills during the Pipe Line Contractors' meeting are, left to right, Robert K. Shivel, H. C. Price Co.; Ernest C. Dunn, Dunn Brothers, Inc.; R. L. Ezell, H. C. Price Co.; and D. Michael Curran, Curran & Co.

ROGER L. PENTZIEN, left, of Pentzien, Inc., discusses the pipeline contracting business with R. P.

Pipeliners are hopeful of change in

- The new thinking expected from the Kennedy administration is expected to bring changes in FPC procedures which will help speed up hearings. A better atmosphere in Washington should mean an increase in gas pipeline construction.

BY PAUL REED
Pipeline Editor
AND CARL LAWRENCE
West Coast Editor

THE INDUSTRY'S pipeline contractors are entering 1961 knowing no big building boom is expected during the year, but hopeful that some changes in Washington will create a better climate for pipeline building.

The feeling running through the thirteenth annual meeting of the Pipe Line Contractors Association in San Francisco last week was pretty well summed up by the association's retiring president, Jack S. Gray, when he said pipeliners should look at 1961 with "guarded optimism."

Gardiner Symonds, chairman of Tennessee Gas Transmission Co., and one of the principal speakers at the meeting, sounded a similar, but more pessimisitic, note.

Symonds said his company has no main-line expansion planned in 1961 and laid the blame for the slowdown in pipeline work on the delaying and unrealistic policies of the Federal Power Commission staff.

The Tennessee Gas chairman says he can see nothing which will stop the downward trend in pipeline construction "until the FPC faces up to reality and its decisions begin to mesh with facts and present-day economics."

Actually there is a ring of optimism in Symonds' remarks since he leaves the door wide open for an increase in pipeline building once the regulatory barriers in Washington are removed.

Symonds and some of the other pipeliners attending last week's meeting feel the incoming Kennedy administration will bring some needed changes in the regulations which are impeding pipeline plans.

The feeling expressed by some was that any change will be an improvement and that any decisions, even though they might be adverse, would at least break the stalemate which has delayed many pipeline projects.

Gregory, of Houston Contracting Co. during a break in the convention schedule.

GETTING SOME FRESH AIR during the San Francisco meeting are three well-known pipeliners, left to right, A. L. Lundberg, O. R. Burden Construction Corp.; Joe L. Work, Bechtel Corp.; and C. C. Bledsoe, of Stanley-Bledsoe Corp.

Washington

In his speech, Symonds said the new President "will bring a new youthful approach to the problems of regulation and all the other problems that face them (the new administration)."

"I am convinced that they have the desire to do a job," he added.

Current projects. Several pipelines figured in the conversation among pipeliners last week.

Two projects discussed were:

...The Transwestern Pipeline Co. gas line running from Texas to California. Transwestern's line continues to get attention since there is a possibility the 15% interest Monterey Oil Co. holds in the line will be sold. Monterey recently sold out to Humble Oil & Refining Co., but the Transwestern stock was not part of the deal.

There have been reports Tennessee Gas was interested in buying the Transwestern stock, but Symonds said his company "has never had nor will have any interest" in buying the stock.

...The Texas to California via Mexico line planned by Tennessee Gas to supply Southern California Edison Co., the big Los Angeles electric utility.

TGT's Gardiner Symonds
... says FPC needs realistic approach.

To date all talk of this line has included Mexican gas as part of the supply, but reports heard last week leave little doubt this line could be built along a U. S. route and supplied solely from domestic sources.

The project calls for about 80% of the gas to be supplied by Humble and the remainder by Petroleo Mexicanos from fields in northern Mexico. Edison is buying the gas directly from the producer with Tennessee Gas serving only as a transporter. Once the gas reaches California, it would not be available for resale by Edison.

Bright spots. Not all is gloomy in the pipeline field, according to Symonds.

He pointed out pipelines have "built-in efficiencies, economies, dependability, low labor-cost content, and other advantages" which make pipelines far superior to other forms of transportation.

The consumer may also help alleviate the pipeliners' problems, he said. Under present regulations, the consumer eventually would have "a

A FATHER-SON combination attending the meeting was Charles S. LeNoir and Charles S. LeNoir, Jr., of C. S. LeNoir Construction Co.

SIGNING IN at the Pipe Line Contractors' meeting is J. W. Sharman, of Sharman, Allen, Gay & Taylor, Inc.

HAROLD C. PRICE, of H. C. Price Co., a past president of the association, was on hand in San Francisco.

ANOTHER PAST PRESIDENT who attended the San Francisco meeting was John H. Williams of Williams Brothers.

real problem as to both gas supply and price, the latter because of scarcity and allocations." And when the consumer is hurt, he will demand and get action that should bring about improved regulations.

The FPC. The problems confronting pipelines in Washington also were touched on by Gray, the outgoing president, and by George R. Perrine, chairman of the Illinois Commerce Commission and another principal speaker. (The text of Gray's speech begins on page 70 and of Perrine's speech on page 71.)

In attacking the FPC's practices, Symonds says he agrees with James Landis, of the new Kennedy administration, who says the FPC has not sufficiently protected the consumer.

He cited the long delays connected with both the "Northeastern Gas" and "Midwestern Gas" cases. These delays resulted in several renegotiations between the pipeline and the producers.

"The resulting increases in the price of gas to the consumers will amount, over the years, to far more than any increase in rate of return our company ever sought," Symonds said.

The FPC has proved it can make important decisions within a week, but they hardly ever do, Symonds said. The Phillips case decision, he pointed out, took 7 years and the Midwestern case took 5 years.

"It is difficult to believe the policies set by the FPC staff and followed by the commission are accidental. There appears to be a deliberate design to destroy the credit of the pipeline companies. The 'why' is obscure. But the results are clear.

"Some of the heads of other pipeline companies may not be as frank with you as I am being here this morning. But I think the hard facts add up to a situation something like we had before the Supreme Court overturned the Memphis decision—a feeling of disillusionment, uncertainty, and above all, an unwillingness to spend capital funds."

Symonds said FPC actions have resulted in unequal treatment for the three main segments of the gas industry:

... **The producer** has been taken care of by FPC with the area-pricing formula in the Phillips decision.

... **The consumer** has been taken care of by the slow-moving practices

IN THIS HUDDLE at the Pipe Line Contractors' meeting are, left to right, Ray Gilbert, El Paso Natural Gas Co.; C. Paul Evans and John W. Brand, Crose-Perrault Equipment Co.; Walter J. Nolan, Oklahoma Contracting Co.; and Ben Montgomery, Crose-Perrault.

LEAVING one of the committee meetings is James P. Neill, of J. P. Neill & Co., Inc.

of the commission. The delays have given consumers advantages since the pipelines are harassed to the point that "some of them will settle for a fraction of what they have coming to them, just to get something done."

... **The pipelines** are left "with the residue," he said. As a result of this unequal treatment, Tennessee Gas is not going to expand its pipeline system next year, but instead will expand its unregulated operations outside the pipeline field.

Low rate of return. Symonds said the FPC has an obligation to consumers to realize that regulation involves something other than "just hammering down gas rates."

He said the FPC should realize it must also regulate pipelines so that they can remain financially healthy and can continue to give the consumer an uninterrupted gas supply at fair prices.

He pointed out there is a wide gap between the higher interest costs pipelines must pay and the increases the FPC grants in the form of a higher rate of return.

During the last 15 years, the interest rate has increased 64% from a base of about 2.6% while the increase pipelines have been granted in rates of return have amounted to only 2%, from 6% to 6⅛%.

"What this means is this. Suppose a company has a pipeline system and wants to build a substantial addition to it in order to take care of the growing needs of its customers. Pinched by the FPC rate of return formula currently in vogue, the company's existing stockholders would be worse off after the addition was built than before.

"Why? Because the earnings contributed by the new addition per dollar invested would be less than the average earned by the pipeline system before the addition."

Symonds said this investment and rate of return concept ultimately will block the pipelines' access to capital markets.

"And with reduced capital, there follows reduced growth, or in other words, reduced pipelining," he warned.

Double jointing. Another major gas-pipeline-company executive attending last week's meeting was pushing for changes in another type of regulation—the highway regulations covering the length of a truck's load.

He said the pipeline industry is in need of uniform highway regulations throughout the country so that double joints of pipe can be hauled on all roads. Many states now have highway regulations which prohibit double jointing because the states prohibit long loads on trucks.

Double jointing is an obvious way to cut pipeline construction costs, but the method is being held back in many areas due to local highway regulations.

The pipeliner said double jointing was possible on only about 10% of a several-hundred-mile looping program his company did last year due to the highway restrictions.

Pipeline contractors elect officers

MAURICE S. WILLIAMS, president of Panama-Williams Corp., Houston, was elected president of the Pipe Line Contractors Association at the group's annual meeting in San Francisco. Williams succeeds Jack S. Gray, of Grayco Constructors, Inc., Austin.

Other new officers elected:

J. W. Sharman, Sharman, Allen, Gay & Taylor, Inc., Houston, first vice president; Roger L. Pentzien, Pentzien, Inc., Omaha, second vice president; and Arthur E. Poole, Hallen Construction Co., Island Park, N. Y., treasurer.

Three new directors who were elected are Robert D. Sheehan, Sheehan Pipe Line Construction Co., Tulsa; C. Wayne Fowler, Fowler - Tatom Pipeline Contractors, Inc., Cotton Valley, La.; and R. D. Cagney, Contracting & Material Co., Evanston, Ill.

1959-60 statistics of 40 contractors in new system of reporting on construction work

		1959	1960	TOTALS 1959	TOTALS 1960
CRUDE	Trunk	547	378		
	Gath.	0	123		
	Total			547	501
PRODUCTS				864	3,202
GAS	Trans.	6,957	6,103		
	Gath.	732	1,412		
	Dist.	1,107	1,077		
	Total			8,786	8,592
WATER				56	28
GRAND TOTAL				10,263	12,323

Pipeline contractors in middle of a severe price squeeze

REPORTS of 40 pipeline contractors to the Pipe Line Contractors Association show that these firms constructed 12,323 miles of pipelines in 1960, largely in the United States. This represents a 20% increase over the mileage constructed by the same firms in 1959.

The 40 contractors grossed 185 million dollars, a 24.1% increase over the 149 million reported for 1959.

New system. Last year the association started using a new system of reporting on construction work. This system will give us more significant figures in the long run. It has the temporary disadvantage of limiting our statistical comparisons to the last 2 years.

The comparative spread statistics for 1959 and 1960, as reported to the association, are shown in the cut.

While reports were not requested from the nine specialty contractors who are regular members of the association, these figures do cover the reports of all except three of the other regular members. Thus, we feel that they encompass almost all of the big-diameter-line work in 1960.

These figures cover the work of 111 spreads actually used in 1960—17 more than were on the job in 1959. The number of spreads reported available for 1961 is 114.

Significance. These are the statistics for 1960. They indicate that 1960 was not very much different from 1959—a somewhat greater volume of work at about the same rate of return. The growing importance of products transmission is reflected in an almost fourfold increase in that type of construction. This increase more than accounted for the over-all mileage gain in 1960.

A drop in construction for crude-oil transmission might or might not be significant in itself, but at least it reminds us that the oil industry has many painful problems which we, to some extent, must share.

Some more or less valid deductions might be made by comparing current mileage and dollar-volume totals with those for 1958. These show that in 1960 we laid 20% **more** miles of line for 20% **less** money. From those figures we would **like** to deduce that we have become approximately 40% more efficient in the last 2 years. I am afraid they mean, instead, that pipeline contractors are in the middle of a severe **cost-price squeeze.**

. . . believes Jack S. Gray, retiring PLCA president

Jack S. Gray is president of Grayco Contractors, Inc., Austin, Tex. He has been a pipeline contractor since 1951 and has been in big-inch pipelining since 1954.

Last year at this time we were wondering how long we could continue to buck this trend of higher costs and thinner profit margins. We can only say, at this time, that we have made it for another year. The problem is, more than ever, a real one, and a serious one—for pipeline

contractors, of course, and for pipeline owners as well, for they above all others must be interested in a s o u n d, efficient pipeline-construction industry.

The increasing emphasis on short loop lines, as contrasted with the long crosscountry type, contributes to the "squeeze" and puts pressure on the contractor to f i g u r e jobs more closely and carefully.

Pipeline contractors, along with the owners, are caught in the general economic downtrend which the experts **hope** will be of short duration— but which may or may not break in time to beef up 1961 work schedules.

FPC action. Also pertinent to our future, of course, is the speed, or lack of it, with which the Federal Power Commission acts upon pending applications. The necessity of having to bid on jobs that have not been approved, and for which a starting time can only be **guessed at,** adds another risk to the construction business.

In these uncertain times, many contractors have turned toward **diversification** as a sort of h e d g e. When I entered this business 10 years ago, the sign of growth was to add more spreads. Now most of us are looking around to see what else we might do besides dig ditches.

We look also for new and better ways of doing things, and for the improved equipment that makes improved techniques possible. We look for work in new places; a number of contractors are finding opportunities in foreign countries. A domestic development of the not-too-distant future may well be the construction of big-inch water lines from the seacoast to industrial and municipal users, as soon as the purification of sea w a t e r becomes commercially feasible.

These conclusions, of course, are my own, made after only a few years in this interesting business. There are many members of this association better qualified to evaluate the changing scene. But I am sure we all join in facing 1961 with **guarded optimism,** and with confidence that the pipeline contractors of America this year—as in years past—will contribute efficiently and effectively to the growth of the vital fuel-transportation industry.

Do your talking where it counts

If legalistic red tape has you tied in knots, talk to senators and regulatory officials, this official urges. Industry contacts are welcome, he declares.

BY GEORGE R. PERRINE

. . . chairman, Illinois Commerce Commission, now serving his second term on the commission. He is a member of the Council of the American Bar Association's Section of Public Utility Law and was 1959-60 president of the National Association of Railroad and Utilities Commissioners. He has written numerous articles on public-utility subjects. Accompanying is an abridged version of his address before the San Francisco meeting of the Pipe Line Contractors Association.

WE IN ILLINOIS have first-hand information about the pipeline industry because one of the pioneer interstate lines was constructed in the early thirties by Natural Gas Pipe Line Co. of America from Texas to Chicago. Later Panhandle Eastern Pipe Line Co. completed another line of over 1,100 miles, traversing the State of Illinois.

Construction of these pipeline systems began an era of expansion that even the most optimistic planners never dreamed of. In the United States there are over 600,000 miles of pipeline facilities transporting natural gas.

I can remember the early thirties when the Natural Gas Pipe Line was completed. It was a time when the country was going through one of the most cataclysmic economic depressions in modern history. Many contracts for the gas had been executed before the depression had set in. Coal was still very reasonable and the people were so poor that they couldn't afford gas. As World War II caused prices to rise, people realized that gas was available at lower costs than coal and other fuels. By the close of World War II, costs of other fuels had run far ahead of gas. The heating market was flooded with requests for this all-important fuel. D i s t r i b u t i o n companies had to establish waiting lists for utility service.

Economic drama. This tremendous demand caused many pipeliners to expand and probably some of you even came into existence as the result of it. Production, transmission, and consumption of natural gas provide one of the great dramas of modern economic history.

One does not have to be an economist to realize its impact on our economy. When one thinks of a depression baby in the terms of a few millions of dollars and then realizes that it jumped from this comparatively small figure in 1937

"Let congress know how delays hurt employment, cut use of steel," Illinois Commerce Commission Chairman Perrine advises pipeline contractors.

to an estimated 20 billions of dollars in 1959 and that the predictions are it will increase to, roughly, 50 billions by 1970, it is easy to visualize the impact of such expenditures on the economy.

During this tremendous growth it was only natural that federal and state governments should start taking regulatory action. The pipeline industry, itself, sought state regulation to protect itself from other gas companies and pipelines and to receive the right of eminent domain.

Federal intervention. As the gas began to move interstate, it became apparent that federal regulation would have to fill the gap states could not. In 1938 the Natural Gas Act was passed. Its administration was turned over to the Federal Power Commission.

For awhile the commission was able to keep up with the problems thrust upon it. Certifications for new pipelines and extensions of existing lines were granted rather expeditiously.

What caused the commission to suddenly run way behind is conjectural. Several causes might be pointed out: A breakdown of commission-staff relations when the commission faced an unprecedented amount of work; an impediment that developed because of competition among pipelines; the responsibility that was placed upon the commission by the Supreme Court in 1954 by the Phillips decision; or all these causes plus others that do not immediately meet the eye.

The Phillips decision, whereby the FPC received 12,500 independent producers certificate applications, has been a factor in creating this tremendous backlog.

Expansion slowed. The apparent unwillingness of the staff to take a position until so late that it could not be adequately met has created concern on the part of the industry. Interminable delays in getting cases decided have slowed expansion of the industry in the last few years.

The Special Subcommittee Report on Legislative Oversight says: "It is clear from the subcommittee's hearings that, because of intolerable delays in thousands of pending FPC proceedings, there have been numerous ex parte contacts or extra-record communications with members of the Commission by persons seeking expedition and other assistance."

Several years ago, when two new pipeline suppliers filed application with the FPC, the Illinois Commission went before it to urge their expedition. We explained that we were not too interested in a few cents in cost as much as we were in additional supply.

We used every means available to expedite this case. We even called a meeting of contesting parties to work out differences. An understanding was reached. We returned to the commission and reported the results.

It was then that I had my eye teeth cut. I had never before realized the tremendous amount of red tape in processing a case through FPC.

Staff anticonsumer. It seems to me that the commission's staff assumes the position of protecting the public from the very commodity that it wants. It appears that the commis-

sioners themselves are powerless when they attempt to expedite these hearings.

From the start of the Midwestern hearings in October 1955 until the final certification was granted the public has suffered a loss of $2,-250,000 per year—or for the 20-life of contract some $45 millions.

Michigan and Wisconsin consumers are not alone when it comes to costly consequences of FPC delay. Hearings before the Special Subcommittee on Legislative Oversight show that consumers in the Northeast have had to pay an additional 3 cents per M.c.f. because of commission delay. Attorney Randall J. LeBoeuf, Jr., told the special subcommittee, "The fault with which I believe this commission justly should be charged is unwarranted delay in the performance of its duties—delay that is costly to the ultimate consumer, harmful to the investor and which impairs the progress and efficiency of great segments of the electric and gas industries."

Ex parte contacts. Much of the testimony before the subcommittee on Legislative Oversight dealt with ex parte contacts with the FPC commissioners and staff.

If I were the president of a company seeking to expand our facilities and months and years went by before I could get a decision, I am sure I would be before the FPC endeavoring to find out why. I would have my legal staff, my engineering staff, and all other necessary personnel waiting on the commission and its staff diligently.

The staff report of the Committee on Legislative Oversight gives one the feeling that these gentlemen are sympathetic with the industry when it comes to ex parte contacts. I, as a member of the Illinois Commission, welcome industry contacts. It is my feeling that commissioners must have all the information available in order to intelligently regulate. We are not courts of law but administrative bodies. Industry people and their lawyers have never gone beyond the bounds of decent restraint in their contacts with me.

The Landis report to President-Elect Kennedy agrees with my position: "This tendency toward industry orientation is subtle and difficult to deal with. It arises primarily from the fact that of necessity contacts with the industry are frequent and generally productive of intelligent ideas. Contacts with the public, however, are rare and generally unproductive of anything except complaint. For example, the public that our security legislation is designed to protect is the "investor", but the investor rarely appears and when he does he is too rarely an investor and too frequently a speculator who deserves exactly what happened to him."

Landis hits FPC. I would say that the Landis report is hypercritical of FPC. It states: "The Commission's past inaction and past disregard of the consumer interest has led the states to seek to force it to discharge its responsibilities. It is somewhat of a phenomenon in our national life for the state utility commissions to be ranged against a federal commission in an effort to protect consumers against monopolistic and excessive rates. That, however, is today's picture of federal regulation of the natural-gas industry."

At the 1959 National Association of Railroad and Utilities Commissioners' convention the executive committee authorized me, the president, to establish a Special Committee to Study Natural Gas Rate Problems. The report rendered at our convention in Las Vegas was not an indictment of FPC, but called for legislative action to help it.

One suggestion was that companies should not be permitted to file a second rate increase while the first was still pending.

I have known of three such proceedings being on file by the same company and being processed at different stages at the same time. Several years have elapsed prior to final decision in the first case. This is unworkable and seriously hampers pipeline expansion—and besides, would be unconstitutional.

It does not serve any useful purpose for FPC to expedite certifications unless thought is given to financing. The natural-gas industry has high debt ratios in proportion to common-stock equity. This has been a great factor in its ability to expand. The people who supply the money are aware that tremendous demands exist.

Returns whittled. During the early days the Federal Power Commission treated you very favorably in your return on equity. Recently, however, there seems to be some "whittling" on the rate of return allowed transportation companies. I think this is not commission rationale, but rather "staff thinking." The staff brief in a recent Northern Natural case says, "According to basic economic concepts, the rate with which the Commission is here concerned represents the remnant of what was once capital's share of the fruits of the joint endeavor of capital and labor." This new policy, resulting in a lower rate of return to the common equity holder, will stifle the efforts of industry to expand.

I am told that the industry intends to spend 2 or 3 billion dollars annually. To meet these demands and supply the market, the pipeline industry must have its certifications without undue delay. Once a competitive fuel has preempted the market, it is very difficult to get a consumer to change.

If the increase in transmission investment is to proceed to $4 billion annually, the commission must proceed at a rate comparable thereto. This commission must have sufficient wisdom to allow a just rate of return on invested capital.

How to help. You may ask, "What can we do to help?" I would say that what I have discussed here should make it clear what your position should be. If the industry is to grow, the pipeline companies must also, as expeditiously as possible, receive their orders from the Federal Power Commission. Your attendance at congressional hearings where you could make direct contacts with members of Congress might prove invaluable, aiding the commission to secure the financing it claims it needs to be properly staffed, or letting the government know the problems of your industry and the unemployment not only in your industry but in the steel mills if decisions are unduly delayed.

Read the Landis report to President-Elect Kennedy. I recommend it to you. Read the staff committee report to the Special Committee on Legislative Oversight. You, as leaders in your industry, should make it your business to be well informed so that your industry can continue to move forward and keep pace with the economic growth of our country.

JOB PLANNING began on PCI's first ethylene plant turnaround 3 months before actual shutdown. The most important phase of the turnaround was the complete dismantling, inspection, and repair of three 13,000-hp. gas turbines and the nine centrifugal compressors that they drive.

Giant gas turbines get overhauling

. . . in first turnaround of PCI's ethylene plant

BY J. E. FENEX, JR., HARVEY SIMS, AND P. M. ABLESON
Petroleum Chemicals, Inc.
Lake Charles, La.

FIRST FULL-SCALE turnaround of its 200-million-pound ethylene plant was successfully conducted by Petroleum Chemicals, Inc. Part of the turnaround consisted of routine cleaning and inspection work common to many plants in the petrochemical industry. A major portion of the turnaround, however, was unique to PCI, and probably to the industry in general.

The largest single job was the complete dismantling, inspection, and repair of three 13,000-hp. General Electric gas turbines. These machines were numbers 3, 4, and 5 of their kind and had been in essentially continuous service since September 1958. Second-largest job was the complete dismantling, inspection, repair, and modification of nine Ingersoll-Rand centrifugal compressors. The modification was to increase the capacity of the plant to its ultimate design of 300 million pounds per year of ethylene.

These two jobs were in effect one big job since the three gas turbines and the nine compressor cases were all located in the 60-by-120-ft. compressor building nestled in the center of the unit. This building is surrounded by equipment on three sides with the normal access way to the battery limits on the fourth side.

Job Planning

The detailed planning began over 3 months prior to the turnaround. Each piece of equipment was assigned a place for overhaul, either the PCI machine shop or outside contractor shops. Due to limited space in the compressor building, work was done in place on only the items of equipment which could not be readily moved. This included the bottom halves of the three gas-turbine cases and four compressor cases. All the rest of the rotating elements and cases on the gas turbines and compressors were moved from the area.

Equipment handling. Since all major items of equipment had to be moved to the respective machine shops ready for work within the first 48 hours, we placed particular emphasis on equipment handling and transportation facilities. Special jib cranes were installed. Special A-frames and hoists were prefabricated to roll on temporary railroad tracks which straddled each line of compressors.

These facilities, which supplemented the permanent traveling crane in the building, were in place, ready for use prior to the shutdown. In conjunction with mobile cranes and lowboys, these temporary facilities were used in getting the heavy equipment to the battery limits where big semitractors and trailers from outside trucking companies were standing by, ready to rush it to the respective shops.

Needless to say, a rigorous timetable was developed and adhered to in every detail. One slip would have caused a hopeless traffic jam, resulting in waste of manpower and loss of time.

Specially constructed platforms which formed actual extensions of the compressor building provided additional working and storage room in the main building. A large rented tent which was raised just outside the battery limits filled the need for a fairly large area to clean and inspect the many parts from the gas turbines. In addition, many temporary buildings dotted the surrounding area and served as field offices, tool rooms, and warehouses.

Spare parts, the weak link in any major job on rotating equipment, received special attention and to make sure that the thousands of spare parts were available, we asked IBM to prepare special turnaround parts lists. The warehouse in turn inspected and turned out an "on hand" report for each item. The problem was doubly complicated because the right parts had to be in place and available at outside shops as well as at PCI facilities.

Preturnaround training gave excellent results. Not only were detailed job procedures developed, but simulated practice runs were made on the procedures for moving equipment, and dismantling and reassembling compressors and turbines. Many bottlenecks were discovered and corrected.

Since gas-turbine and compressor work was the controlling factor on the length of the turnaround, the extensive planning was well worth the effort. We estimate that 1½ weeks of extra onstream time was obtained.

Job Performance

The actual dismantling, inspection, and overhaul of the gas turbines proceeded smoothly. The machines were generally in good condition and no unexpected difficulties developed.

Turbine inspection. The ordinary inspection methods were used on the gas turbines. Dye penetrant, magnetic particle, fluorescent penetrant and the microscope were all used. The amount of work done, however, was unusual. Over 288 man-hours of sustained dye-penetrant testing was performed. The reader might ask, "Was this necessary?"

As already noted, the three PCI machines were numbers 3, 4, and 5 of this type manufactured. As far as we could determine, these turbines had more hours of operating time than any other machine of this type. Since this was the first time we had been into them, we felt a complete inspection was a must.

PCI, in using dye penetrants, uses a procedure somewhat different from that normally used. We have absolutely no faith in penetrants applied to cold surfaces. If the metal being tested is not at least 70° F., we warm it with a torch. The use of a torch was not advisable in this case, so all parts were heated with steam or hot water.

Penetrant materials were purchased by case lots and distributed to the testing areas. The emulsifier-water method of penetrant removal was used prior to development. This method has proven dependable and faster than hand cleaning.

Gas turbine equipment included two major gear casings with each of the three units, along with a 14,500-hp. load or speed increasing gear at the driving end. To reduce down time, the rotors were taken to GE's area service shop for the complete inspection and maintenance checks on the major rotating assemblies. Other independent related components such as fuel gas control and quick-closing valves were similarly handled. This procedure allowed a major portion of work to progress independently and simultaneously with the job-site activities.

Close inspection of all major components under the technical direction of the turbine manufacturer's representatives allowed complete recording of significant data to establish bench-mark records for future maintenance activity. The gas-tur-

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"Ethylene production requires very close impurity tolerances."

bine equipment showed no major or unusual problems or difficulties and no major parts were replaced.

When the gas turbines were reassembled, the checkout and test firing commenced. This is time-consuming but necessary to assure that the machines are ready for operation.

Compressor modification. The compressors were also found to be in good condition and the job modification proceeded on schedule. Compression equipment in the ethylene plant consists of a four-case feed-gas machine, three-case ethylene machine, and a two-case propylene machine. Each case is connected to the next by a flexible coupling. The compressors operate between 6,800 and 7,200 r.p.m. Imbalance, misalignment, oil whirl, bad bearings, and many other things could be destructive to machines operating at these speeds.

We used IRD* equipment for making vibration analyses on the centrifugal compressors prior to shutdown and again at startup. The analyses not only determine vibration level, but also detect the cause of excessive vibration.

These studies are made periodically as well as before and after scheduled shutdowns. During this turnaround, permanent reference mountings were installed on all four stages of the feed-gas compressor to enable us to obtain readings at the same location each time.

Aside from the more familiar inspection jobs involved in a turnaround we were confronted with the following:

1. The location of infinitesimally small roll leaks in some of the low-temperature exchangers.
2. Nondestructive thickness testing of the elbows and return bends of the cracking furnaces.

Exchanger repair. Ethylene production requires very close impurity tolerances and although the ethylene was still on specification, we had noticed slight rises in two impurities. One of these could be detected by analytical means. The other, because of composition similarity, could not.

By calculation, we knew the first impurity amounted to about 40 lb. per day, and by analytical test, we knew it had to come predominately from one bundle. Also, by calculation, we knew the other impurity amounted to about 500 lb. per day, but because it was so similar in composition to ethylene, analytical tests were of no help in locating the source of leakage. By deductive reasoning, however, we knew it could only be coming from one or more of four exchangers.

So, of over a half-million pounds of daily production, we were looking for a leak, in one case, of 40 lb. per day, and in the other case, several sources totaling 500 lb. per day.

The minute leakage involved, plus the fear of leaving water in low-temperature bundles, ruled out both the old standard hydrostatic test and the air or nitrogen test with soap bubbles. So we obtained a supersensitive halogen-type leak detector in advance of the turnaround.

For the halogen device to work there must, of course, be a halogen in the substance tested for. To fill this requirement, we pressurized the shell sides of the exchangers being tested with nitrogen and introduced a small quantity of freon 12. We arbitrarily decided to use 2 lb. of freon in exchangers smaller than 36 in. o.d. and 4 lb. in those above 36 in. o.d. Since we have learned how to accurately determine the right amount of tracer gas to use.

We ran into one problem with the instrument. It was so sensitive that a leak in one tube roll would show indications anywhere in the near vicinity. For this reason, it became more practical to reroll the 10 or 12 tubes nearest the instrument's sensing element than to try to pinpoint the leak. The procedure worked successfully and following the startup all impurities were back to their normal low level.

Furnace inspection. The nondestructive thickness testing of return bends and elbows of the cracking furnaces may be of particular interest to some operators.

The return bends and elbows throughout the hot section of the furnaces are cast from type 309 stainless steel.

Failure of these castings began, after about 8 months of operation, due to internal erosion in a narrow groove on the inside back wall. None of our inspection instruments would detect this attack. As a result, we were constantly up and down with the furnace for about 3 weeks straight. We considered radiographing the elbows but this would mean allowing time for the furnace involved to cool.

We then reasoned that a gamma-ray thickness instrument, which operates on the same principle, might do the trick. A manufacturer of one such device was contacted; a special "head" for the job was designed and put to work immediately on arrival. The results were even better than expected. An unanticipated failure of a casting by erosion is now a rarity.

The instrument chosen was a Model IV Penetron. The special head, which we call the PCI head, is essentially a "straight - through" detector. The source shoots through both the inner and outer walls. With the assumption that the inner wall does not erode (almost correct), then the subtraction of inner wall thickness from the reading of the instrument will give the thickness of the outer wall. The arithmetic is speeded by use of curves.

New equipment tieins. Plans for the near future call for the conversion of the plant's propylene production facilities to high - purity (99% +) production. Since the construction of the additional facilities is currently in progress and their initial operation is scheduled to take place before the next major turnaround, connections to tie the new equipment into the existing process had to be installed at this time.

Some 120 tieins were made ranging in size from 1 to 24 in. When all is ready, the changeover to high-purity propylene production, which involves putting in service two major new fractionation columns and their attendant facilities, will be possible without another shutdown.

*Registered, International Research & Development Corp.

HOW TO REDUCE DRILLING COSTS: PART 9

How to apply hydraulic and bit horsepower

"If the power is actually being generated at the surface, it is a needless waste of money not to put the maximum amount possible at the bit."

BY PRESTON L. MOORE
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THERE ARE FOUR basic points to remember if you are using bit horsepower as the basic design criteria for your jet-bit hydraulics program:

1. If there is no limit within reason on the pump pressure or on the nozzle sizes you may use, bit horsepower is maximum when the rate of flow is the minimum necessary to lift cuttings.
2. If there is some top limit on pressure within the range of your design, the optimum or best circulation rate is the one that puts 65% of the horsepower at the bit.
3. If there is some nozzle size below which you cannot go, you can still select a rate of circulation that gives an optimum bit horsepower under those conditions.
4. In points 2 and 3 above, there is a limit for some reason on our hydraulics. Nevertheless, the circulation rates for both these conditions will be above the minimum necessary to remove cuttings from the hole.

Let us now look at the calculations for bit-hydraulic horsepower.

Laminar or turbulent. When we calculate a hydraulic program for a given rig and well, we generally base our predictions of pressure losses on turbulent flow. And, actually, flow through surface connections, drill pipe, and bit is generally turbulent. That in the annulus may be either turbulent or laminar.

Pressure loss in the annulus is normally quite small compared to that in the remainder of the circulating system. Thus, the error involved when we always assume turbulence has little effect on the hydraulics program for most operations. For this reason, all our following discussion of pressure losses is based on turbulent flow.

What is bit horsepower? Bit hydraulic horsepower is the rate at which fluid performs work below the bit. We can express this mathematically:

$$hp_B = \frac{P_B Q}{1{,}714} \qquad (1)$$

Where:

hp_B = hydraulic bit horsepower
P_B = pressure drop through bit nozzles, psi.
Q = volume rate of flow, g.p.m.
1,714 = units conversion constant for changing pressure, psi., and rate of flow, g.p.m., to units of horsepower

Only difference in Equation 1 and that for surface hydraulic horsepower is the pressure term. It follows, then, that when there are no limiting conditions, bit horsepower is maximum when pressure through the bit approaches surface pressure. This condition arises as rate of flow decreases since a lower flow rate reduces pressure losses in the circulating system excluding the bit.

For example, consider the pressure loss in a given circulating system when flow is in turbulence. The loss is proportional to the rate of flow to the 1.84 power:

$$P \propto Q^{1.84} \text{ or } P = k\,Q^{1.84} \qquad (2)$$

where k is a proportionality constant. We can see that as rate of flow decreases pressure losses in the circulating system fall off and the amount of horsepower available at the bit increases. This is shown in the following example:

Example 1. Assume that surface hydraulic horsepower is 500 and flow rate is 500 g.p.m. Say that pressure loss in the circulating system, excluding bit, is 1,500 psi.

Available surface pressure is 1,714 psi. at 500 g.p.m. calculated as follows:

$$P = \frac{H_p \times 1{,}714}{Q}$$

$$P = \frac{500 \times 1{,}714}{500} = 1{,}714$$

With a drop of 1,500 psi. in the circulating system, only 214 psi. is left for the bit; available bit hydraulic horsepower is about 62.

Now assume this rate of flow is cut to 300 g.p.m. Pressure drop in the circulating system, excluding bit, is 575 psi.:

$$\left(\frac{300}{500}\right)^{1.84} \times 1{,}500 = 575$$

Available surface pressure at this rate of flow is 2,855 psi.:

$$\left(\frac{500}{300} \times 1{,}714\right) = 2{,}855$$

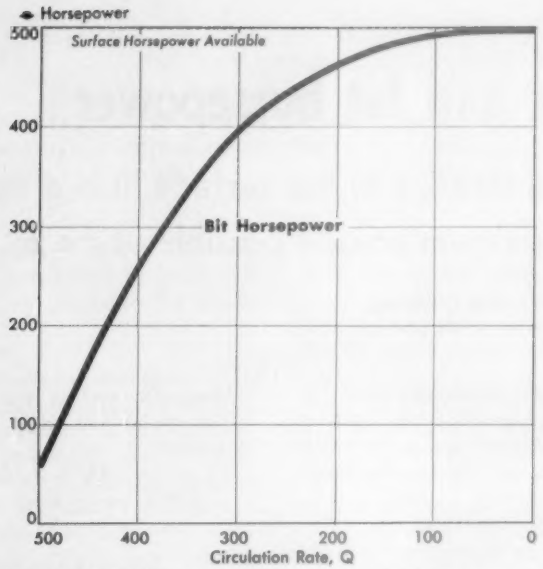
Therefore the amount of pressure available at the bit is:

$$2{,}855 - 575 = 2{,}280 \text{ psi.}$$

and the bit horsepower is 400.

Thus, reducing circulation rate from 500 g.p.m. to 300 g.p.m., raised bit horsepower from 62 to 400. The fluid is actually capable of performing 6.5 times more work below the bit at the lower rate of circulation. Reducing rate of flow even further, if there were no limitations on rate of flow or surface pressure, would increase bit hydraulic horsepower further. This is shown in Fig. 1.

What annular velocity? Obviously, there are limits on flow rate and



BIT HORSEPOWER is maximum when circulating rate is the minimum necessary to lift the cuttings from the hole. As this curve shows, as the circulating rate is increased above this minimum, less of the available surface horsepower can be put on the bit. Fig. 1.

surface pressure. To remove cuttings, we must have at least some minimum annular velocity. In general, the minimum annular velocity considered necessary with water is 120 ft. per minute. With mud, according to present theory, annular velocity could be lower and still adequately remove cuttings.

This removal of cuttings may depend on the flow pattern, that is, whether the fluid in the annulus is in laminar or turbulent flow. In laminar flow the lift is a function of lift velocity, fluid density, and fluid viscosity. Therefore, in laminar flow as fluid-density or viscosity rise, flow velocity may be something less than 120 ft. per minute.

In turbulent flow, lift of cuttings depends on lift velocity and fluid density. Therefore, in turbulence, the lift velocity may be reduced as density increases.

Few of these changes in fluid properties are defined quantitatively, so industry in general selects a minimum annular velocity regardless of mud properties. With mud this minimum annular velocity is from 90 to 120 ft. per minute. Actually with 16-lb. per gal. mud, it would be entirely possible to remove cuttings with annular velocities below 50 ft. per minute.

However, using accepted practices annular velocity becomes an important factor in design of a hydraulics program based on bit horsepower. If there are no other limitations, first consideration is to select a rate of flow that results in the predetermined annular velocity considered necessary to remove cuttings. This is illustrated in Example 2:

Example 2. Assume that hole size is 9 in. Assume also that drill pipe is 4½ in. and drill collars are 7-in. o.d. and 2⅞-in. i.d. Consider that we are drilling at 10,000 ft. with 600 ft. of collars in 10-lb. per gal. mud. We consider we need an annular velocity of 120 ft. per minute. We have 500 surface horsepower from a 16-in.-stroke pump.

We calculate:

Annular hole volume = 0.0594 bbl./ft.

Then flow rate = 0.0594 × 120 = 7.11 bbl. per minute or 300 g.p.m.

Pressure losses (except bit) = 530 psi.

Available surface pressure

$$= \frac{500 \times 1{,}714}{300} = 2{,}855 \text{ psi.}$$

$$\text{Bit. hp.} = \frac{(2{,}860 - 530)\,(300)}{1{,}714}$$

$$= 407$$

With this program, surface pressure would be 2,855 psi., annular velocity 120 ft. per minute, and bit horsepower 407. Therefore, if there are no other limitations, this approach is a simple method to design a hydraulics program based on bit horsepower. The bit nozzle size would be based on a pressure drop of 2,330 psi. and a flow rate of 300 g.p.m. Under these conditions the nozzle size in a tricone bit would be less than 5/16 in. in size.

In the above program it is doubtful, first, that surface pressure would be allowed to reach 2,855 psi. Second, nozzle sizes as small as those listed would probably not be used. Consider the problems connected with surface pressure: For some reason, surface pressure may be limited to 2,000 psi., frequently an upper limit. Then, a flow rate of 300 g.p.m. results in the use of only 350 hp. of the 500 hp. available:

$$\left(\frac{2{,}000 \times 300}{1{,}714}\right) = 350$$

There is now the question of what flow rate should be to obtain a maximum bit horsepower. With 300 g.p.m. and pressure limited to 2,000 psi., the bit horsepower will be:

$$\left(\frac{300 \times 1{,}470}{1{,}714}\right) = 257 \text{ hp.}$$

Now let's look at the maximum flow rate possible with a surface horsepower of 500 and surface pressure of 2,000 psi.

$$\text{Flow rate} = \frac{1{,}714 \times 500}{2{,}000}$$

$$= 430 \text{ g.p.m.}$$

Using this rate of flow, pressure loss in the system, excluding the bit, is about 1,030 psi. This leaves 970 psi. available for the bit and the bit horsepower is:

$$\left(\frac{970 \times 430}{1{,}714}\right) = 243$$

Nozzle area would need to be 0.43 sq. in., which would be equal to one 13/32 and two 7/16-in. nozzles in a tricone bit. By trial and

error you could find a flow rate that would give a maximum bit horsepower with this pressure limitation. This is unnecessary since the exact maximum can be obtained mathematically as follows.

Maximizing bit horsepower. We know that:

$$hp_s = hp_c + hp_B$$

Where:

hp_s = surface horsepower

hp_c = horsepower loss in circulating system

hp_B = bit horsepower

Equation 1 can be written as follows:

$$\frac{P_s Q}{1{,}714} = \frac{P_c Q}{1{,}714} + \frac{P_B Q}{1{,}714}$$

where P_s, P_c, and P_B represent the pressure at the surface, in the circulating system, and through the bit. Remember we previously stated that $P_c \propto Q^{1.84}$ or $P_c = kQ^{1.84}$. Thus, Equation 1 may be written as:

$$hp_B = \frac{P_s Q}{1{,}714} - \frac{k Q^{2.84}}{1{,}714} \quad (3)$$

From this equation, we can find maximum bit horsepower as a function of circulation rate by setting the derivative of Equation 3 equal to zero or:

$$\frac{d(hp_B)}{dQ} = \frac{P_s}{1{,}714} - \frac{2.84\, k\, Q^{1.84}}{1{,}714} = 0$$

Since P_s is considered as limited and within the range of interest constant, it is fixed and not a function of Q. Therefore, since $P_c = kQ^{1.84}$, $P_s = 2.84\, P_c$, or the pressure loss in the circulating system is found to be 35% of the surface pressure for the case of maximum bit horsepower. From this it is clear that bit horsepower will be maximum for the pressure-limited case when the rate of circulation results in loss of 35% of the horsepower or pressure in the circulating system (excluding the bit) and 65% of the power is expended through the bit.

Reworking Example 2. Using this development, let's return to Example 2, and assume that surface pressure is limited to 2,000 psi. We can calculate the optimum rate of circulation after we have figured the pressure losses for one set of conditions. For example, the pressure loss in the circulating system should be 35% of 2,000 or 700 psi.; that through the bit should be 1,300 psi. We calculated in Example 2 that at 300 g.p.m., the pressure loss is 530 psi. Then, circulation rate for a loss of 700 psi. may be calculated as follows:

$$\frac{Q^{1.84}}{(300)^{1.84}} \times 530 = 700$$

$$Q^{1.84} = \frac{300^{1.84} \times 700}{530} = 47{,}500$$

$$Q = 350 \text{ g.p.m.}$$

You can see that it is no harder to select an optimum rate of circulation for a system where pressure is limited than it is to select a given rate and then extend this rate to obtain the optimum.

With the 350-g.p.m. rate of circulation we calculated in this example where pressure is limited, bit horsepower is 265. Annular velocity is 140 ft. per minute.

At this rate of flow and surface pressure limited to 2,000 psi. it is possible to use only 406 surface horsepower.

$$\frac{350 \times 2{,}000}{1{,}714} = 406$$

So, as a result of the surface limitation on pressure, the 500 hp. available at the surface is not used.

The combination of a 350-g.p.m. circulation rate and a 1,300-psi. pressure drop through the bit requires a nozzle area of 0.2960 sq. in. This need is met by two 11/32 and one 3/8-in. nozzles.

What size nozzles? We also mentioned another frequent limitation: that placed on nozzle sizes. In practice, most operators will not use a nozzle less than 5/16 in. in diameter. Many may use nozzles no smaller than 3/8 in. in diameter.

The important thing in developing bit horsepower is the effective nozzle area. Thus, if need be, it is possible to plug one nozzle of a three-cone bit. For example, say the hydraulics program calls for three 5/16-in. nozzles. We could substitute two 3/8-in. nozzles and have about the same nozzle area.

Suppose the operator for some reason resists the idea of using nozzle sizes smaller than 3/8 in. and still insists on using all three bit nozzles. Then, the hydraulics program must of necessity be built around these limitations. In this case, we want to use the maximum flow rate that permits staying within limits which here include a selected nozzle area. Here again it is possible to calculate the pressure drop using a given rate of circulation and extend by one calculation to the rate of circulation that will give maximum bit horsepower.

To illustrate, go back to Example 2. With a circulation rate of 300 g.p.m., pressure loss in the circulating system, excluding the bit, is 530 psi. The pressure loss through a nozzle area of 0.3312 sq. in. (three 3/8-in. nozzles) is about 750 psi. This gives a bit horsepower of only 132. And, the 1,280-psi. pressure loss is considerably below the permissible 2,000 psi. pressure. Thus, we can increase the rate of circulation.

The new rate of circulation may be calculated as follows:

$$\frac{Q^{1.84}}{(300)^{1.84}} \times 1{,}280 = 2{,}000 \text{ psi.}$$

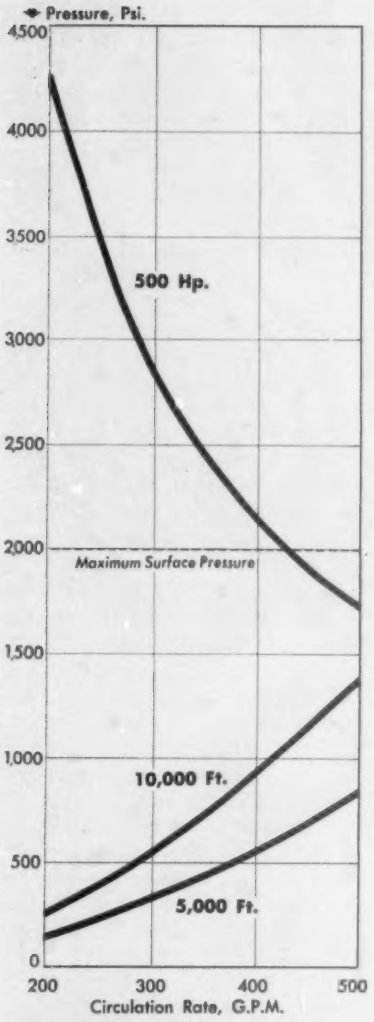
$$Q = 380 \text{ g.p.m.}$$

Pressure loss through the bit at a circulation rate of 380 g.p.m. is about 1,180 psi. Bit horsepower is:

$$\left(\frac{1{,}180 \times 380}{1{,}714}\right) = 261$$

This is only slightly below the optimum bit horsepower of 265. In this case the operator would be penalized only a small amount by using the larger nozzles, provided he recalculated and again used a 380-g.p.m. rate of circulation.

Use a plot. Actually, it is not entirely necessary to use calculations such as those shown. We could also plot circulation rate versus pressure for a given horsepower. On the same



PLOT of circulation rate vs. pressure for constant 500 hp. (in example case) shows that when circulation rate is above 430 g.p.m., pressure available is less than 2,000 psi. Plot of pressure loss in all of system except bit shows increase of loss as circulation rate increases. Fig. 2.

graph we could plot the pressure loss excluding the bit, versus circulation rate for a given circulating system. From this plot we can select the optimum rate of circulation for the pressure limited condition.

This is shown in Fig. 2, where the conditions are the same as those in Example 2. Note from the graph that the optimum circulation rate at 10,000 ft. for the surface-pressure-limited case is about 350 g.p.m.

Another type of case. There is another condition we have not discussed. That is where surface pressure is limited by the rate of circulation. For example, in Fig. 2, when rate of circulation exceeds 430 g.p.m., pressure available for 500 hp. is less than 2,000 psi. Note that at 5,000 ft., pressure loss in the system (excluding the bit) at 430 g.p.m. is less than 700 psi. The pressure-limited condition no longer exists because surface pressure is no longer fixed at 2,000 psi. As a result, pressure at the surface is no longer fixed but is a function of Q. With this condition, the optimum rate of circulation is that rate obtained when the maximum-permissible surface pressure is used to calculate the maximum possible rate of circulation. For example, the 430 g.p.m. was obtained as follows:

$$Q = \frac{hp \times 1{,}714}{P} = \frac{500 \times 1{,}714}{2{,}000}$$

$$= 430 \text{ g.p.m.}$$

Example 3 demonstrates the concepts from the above discussion showing the design of a hydraulics program to a depth of 12,000 ft.

Example 3. Let us assume we have the same conditions as in Example 1 except that surface casing is set at 2,000 ft. Table 1 shows our solution in the interval 2,000 to 12,000 ft.

Above 2,000 ft., we will assume that the formations are extremely soft and drilling rates are high. For this reason, the rig slush pumps are run in parallel to get high annular velocity. This is common practice to provide adequate cleaning where hole is large and drilling rates high.

Refer to Fig. 2. We can see that for all depths above 6,000 ft., the flow rate that gives maximum bit horsepower is 430 g.p.m.

The rates of circulation below 6,000 ft. are selected so that 65% of the pressure drop is through the bit and 35% is in the remainder of the circulating system. The nozzle sizes chosen are those which come closest to calculated nozzle area in square inches.

To get the desired rates of circulation from 9,000 ft. to total depth, a 5½-in. liner could be used and run at speeds of 68, 65, 62, 59 s.p.m. instead of the 6-in. liner.

Because surface pressure can be no higher than 2,000 psi., bit horsepower is quite limited at the lower depths. For example, bit horsepower at 12,000 ft. is only 239, while at 5,000 ft. it is about 346. Actual bit horsepower varies somewhat with the area provided by the exact nozzle size.

Take a case where there is no limit on pressure either because of surface connections or liners and no limit on nozzle size. Optimum rate of circulation at the lower depths would have been 300 g.p.m., the minimum rate necessary to lift cuttings. At 12,000 ft. the pressure loss at 300 g.p.m. would be about 2,230 psi. through the bit and 625 psi. in the remainder of the circulating system. However, this would have required using two ¼-in. and one 5/16-in. nozzles. Bit horsepower under these conditions would be 390, 62.6% higher than with the pressure held to 2,000 psi.

The significant thing in calculating this program is the fact that even with pressure limited, the optimum circulation rate at all depths was above 300 g.p.m., the minimum necessary for an annular velocity of 120 ft. per minute.

You can use the calculating method above to compare the bit horsepower being used with that possible by the proper selection of bit nozzles. This is important. If the power is actually being generated at the surface, it is a needless waste of money not to put the maximum amount possible at the bit.

TABLE 1 — HYDRAULIC CALCULATIONS FOR INTERVAL, 2,000 TO 12,000 FT.

Depth, ft.	Circ. rate, g.p.m.	Pressure loss excluding bit. psi.	Pressure loss available in bit, psi.	Bit nozzle: Area, sq. in.	Bit nozzle: Three nozzles, size, in.	Pump liner: In.	Pump liner: S.p.m.
2,000	430	384	1,616	0.326	3—3/8	6	66
3,000	430	466	1,534	0.335	3—3/8	6	66
4,000	430	549	1,451	0.345	2—3/8, 1—13/32	6	66
5,000	430	630	1,370	0.355	2—3/8, 1—13/32	6	66
6,000	430	715	1,285	0.369	1—3/8, 2—13/32	6	66
7,000	400	700	1,300	0.338	3—3/8	6	62
8,000	380	700	1,300	0.322	3—3/8	6	59
9,000	365	700	1,300	0.305	1—11/32, 2—3/8	6	57
10,000	350	700	1,300	0.285	2—11/32, 1—3/8	6	55
11,000	330	700	1,300	0.271	3—11/32	6	52
12,000	315	700	1,300	0.263	1—5/16, 2—11/32	6	49

Don't buy paint on price alone

• In the over-all cost of materials purchased by a company, the amount spent for paint may be insignificant; but in view of the effect a coat of paint, its application cost, and the value of equipment it protects, the price per gallon may be multiplied a thousand times.

R. L. GILLOGLY
Paint Technologist
Manufacturing Department
Continental Oil Co.
Ponca City, Okla.

UNLIKE other materials used by the corrosion engineer, paints have features which promote safety, housekeeping, employe morale, public relations, and at the same time serve as advertising.

Paints may be selected on the basis of cost, protection, and appearance. Cost, as it should be, is the first but not the only concern. If it were the only basis of choice, we would limit our colors to black and aluminum.

Surface Conditioning

In developing reasonable cost, we must take into account surface conditions and production schedules. These two items often do not allow us to apply paint under the most ideal conditions.

Typical surface conditions encountered in refinery painting are:

- Intact mill scale.
- Mill-applied preservative coatings.
- Broken and loose mill scale.
- Peeling and abraded paints.
- Pinpoint-sized rust through paint.
- Underfilm corrosion.
- Edge and corner rusting.
- Light rust.
- Heavy rust scale.
- Sound paint.

Paper presented at Oklahoma University corrosion short course, 1960.

Although various hand or power tools are more often used to prepare these surfaces for painting, sandblasting or in some cases pickling are also used. Sandblasting or pickling have the advantage of making the surfaces comparable, so that we are unrestricted in our choice of a generic-type paint system.

Clear penetrants, wetting oils, and rust-inhibitive primers are available to further condition these surfaces for the proper top coat to suit the environment. Phosphoric acid washes seem to have little merit in this type of conditioning.

TABLE 1—MAINTENANCE PAINT-SELECTION CHART

Sandblasted surface—Any high-quality coating system regardless of generic type, provided application conditions are favorable, including high-temperature paints.

Hand-cleaned surface—Any high-quality coating system regardless of generic type, provided application conditions are favorable and surface has been treated properly with adequate priming systems and barrier coats except inorganic zinc silicate and high-temperature paints.

Normal atmospheric conditions—All generic types.

Normal Gulf Coast atmosphere—All generic types.

Chemical fume—All except oleoresinous, alkyd, and zinc compounds.

Acid splash and spillage—Phenolic, chlorinated rubber, urethane, vinyl, asphalt, and bitumen.

Alkali splash and spillage—Catalyzed epoxy, chlorinated rubber, two-component urethane, and vinyl.

Water spray (alternate wet and dry)—Coal-tar epoxy, zinc silicate, two-component urethane, and vinyl.

Solvent splash and spillage—Zinc silicate, catalyzed epoxy, and two-component urethane.

Sweating—Thick film asphalt.

Elevated temperature—Silicone, organic zinc, zinc silicate, urethane, and epoxy.

Application to be made under high humidity—All except amine epoxy.

Application to be made at subfreezing temperatures—Phenolic and hot spray vinyls.

Gloss retention—Alkyd, urethane, and epoxy ester.

Thick film—Asphalt, bitumen, coal tar epoxy, and high build epoxy.

Thin film—Zinc silicate and silicone.

Mill scale. Most inhibitive metal primers may be used on hand or power-tool-cleaned mill scale provided they show good adhesion.

Painting intact mill scale on tanks has been found successful in areas where the average relative humidity is less than 50%. In this case, thin films must be maintained, particularly in areas subject to sudden temperature changes.

Black and aluminum paints have shown long life even under higher humidity conditions. However, tank whites and other heavily pigmented color coats may fail within 1 year at 50% relative humidity because mill scale becomes loose under the paint film.

Our paint costs show a great difference between the use of scale-bearing and scale-free steel for pressure vessels which are subject to sweating. And the difference is greater here than for any other service.

For this reason, we specify complete scale removal on all new tanks which may be subject to sweating. We allow removal by either field sandblasting or by pickling in the mill, but we prefer the latter.

... Preservative coatings rarely perform well unless they have been applied at the mill. Reason is that only loose material is removed when the work is done in the field. Therefore, premature failure may be expected, particularly on equipment operating at high temperatures.

However, by the first repainting the condition has usually corrected itself and, for this reason, the first paint job is given little attention.

... Loose mill scale, peeling and abraded paint, rust pitting, underfilm corrosion, and edge and corner rusting also require extensive cleaning. The surface is usually sanded with a floor-sanding grade of paper as well as cleaned with hand and power tools.

Reasonably high-quality primers

TABLE 2—COST IN CENTS PER SQUARE FOOT PER YEAR OF SERVICE FOR VARIOUS PAINT TYPES

Structure	Condition	Hand cleaning				Sandblast			
		Black	Gray	Aluminum	White	Black	Gray	Aluminum White	Gray (zinc)
Drums (process and storage)	Mild atmosphere	2.4 Alkyd		2.4 Coumarone					
Drums (process and storage)	Fume and water atmosphere		3.7 Epoxy				2.3 Vinyl		
Drums (process and storage)	Severe splash and spillage		4.3 Epoxy		5.6 Epoxy		2.3 Vinyl		
Exchangers (uninsulated)	Mild atmosphere			4.0 Coumarone					
Piping (6-in. process)	Mild atmosphere								
Piping (6-in. process)	Fume and water atmosphere	10.7 Epoxy				6.7 Phenolic			
Piping (6-in. cooling tower)	Water atmosphere	15.4 Phenolic				5.7 Epoxy			4.8 Zinc silicate
Stacks	Mild atmosphere			4.4 Silicone					
Structural work	Mild atmosphere	4.2 Alkyd							
Structural work	Water atmosphere	9.0 Phenolic							5.8 Zinc silicate
Tanks (80,000-bbl.)	Mild atmosphere	0.37 Alkyd		0.37 Coumarone	0.52 Alkyd				
Tanks (80,000-bbl.)	Fume and water atmosphere	1.14 Alkyd		1.91 Coumarone				1.54 Alkyd	
Tanks (1,000-bbl.)	Severe splash and spillage	11.0 Vinyl				6.2 Vinyl		7.4 Vinyl	
Towers	Mild atmosphere			1.23 Coumarone					

with good wetting properties are required for this type of surface. Also, the new clear penetrants, which do not depend upon slow drying for penetration, are being investigated.

In one location we have over 2,000,000 sq. ft. of tank surface which is maintained in the above manner at a cost of $0.37 per square foot per year of service.

... **Light rust** which is common to weathered steel is effectively prepared by hand-sanding and wire-brushing. The same high-quality primer is used as in the preceding case.

... **Heavy rust scale** is difficult if not impossible to remove by hand and power-tool cleaning. Under these conditions it has been found necessary to apply a straight wetting oil to thoroughly saturate the scale. A day or two later an inhibitive prime coat thinned with the same oil is applied.

Finish-Coat Selection

When there is reasonable assurance that the surface is adequately conditioned, finish coats may be selected.

Here again surface treatment is important.

On sandblasted surfaces we are at liberty to choose any generic-type coating without reservation. On hand or power-tool-cleaned surfaces which have been treated with high-quality primer, we cannot use zinc silicate coatings, heat-resisting silicons, or the higher solvency paints such as vinyls. However, if a buffer

TABLE 3—OPTIONAL PAINTING METHODS FOR TWO 15,000-BBL. SPHERES

IMMEDIATE INVESTMENT	FUTURE MAINTENANCE
OPTION A	
Case 1: Acid pickle, shop prime (red lead alkyd), field touchup and two finish coats (conventional tank white) Cost: $2,000—Service: 5 years.	**Case 5:** Spot prime and one complete finish coat as in Case 1. Cost: $800—Service: 3 years.
OPTION B	
Case 2: Sandblast after erection, prime and finish as in Case 1. Cost: $2,400—Service: 6 years.	**Case 6:** Refinish after 5 years, one complete prime coat (epoxy inhibitive type primer) and two finish coats (vinyl white enamel). Cost: $2,100—Service: 8 years. Next painting—$1,500—Service: 8 years.
OPTION C	
Case 1: Same. Cost: $2,000—Service: 5 years.	**Case 6:** Same. Cost: $2,100—Service: 8 years. Next painting—$1,500—Service: 8 years.
OPTION D	
Case 2: Same. Cost: $2,400—Service: 6 years.	**Case 5:** Same. Cost: $800—Service: 3 years.
OPTION E	
Case 3: Acid pickle, shop prime, one field prime coat (epoxy inhibitive-type primer) and two finish coats (vinyl white enamel). Cost: $3,100—Service: 8 years.	**Case 7:** Spot coat and one complete finish as in Case 3. Cost: $1,800—Service: 10 years.
OPTION F	
Case 4: Sandblast after erection, prime and finish as in Case 3. Cost: $3,300—Service: 10 years.	**Case 8:** Spot coat and one complete finish coat as in Case 4. Cost: $1,800—Service: 10 years.

TABLE 4—COST SCHEDULE IN DOLLARS OF VARIOUS METHODS OF TANK PAINTING

Assumptions: (a) Economic Life of 25 Years
(b) Salvage Value Same Under Any Option

	Option A	Option B	Option C	Option D	Option E	Option F
Immediate capitalized expenditure	2,000	2,400	2,000	2,400	3,100	3,300
Total maintenance cost end of twenty-fourth year	5,600	5,100	5,100	5,600	3,600	3,600
Subtotal	7,600	7,500	7,100	8,000	6,700	6,900
After-tax saving from depreciation twenty-fourth year	2,800	2,550	2,550	2,800	1,800	1,800
After-tax Subtotal	4,800	4,950	4,550	5,200	4,900	5,100
After-tax saving from depreciation at 3.8%	950	1,150	950	1,150	1,475	1,575
Total after-tax outlay for 25 years	3,850	3,800	3,600	4,050	3,425	3,525
Rate of return versus Option A	.....	1%	5%	....	2%	2%

coat is applied to allow for solvent compatibility, vinyls may also be used.

Alkyd paints are predominantly used throughout the refining industry; but as we advance more and more into petrochemical manufacturing, we may eventually see a trend for the more chemical-resistant coatings.

Because of the wide difference in chemical exposures, coatings of all generic types have application in a petroleum refinery. The catalyzed epoxies and two-component urethanes are now highly regarded among the more chemical-resistant paints, partly because they are a more recent development but more specifically because they have superior resistance and higher temperature limits.

Selection chart. Seldom do ideal conditions prevail at the time of a coating application; so an attempt has been made to point to the shortcomings of each type of material, Table 1. By elimination, coatings can be selected for a specific case.

For example, cooling-tower piping is probably the most troublesome area in the average refinery. Ordinarily, the inorganic zinc silicate would be chosen for low-cost maintenance. This would require a white metal blast and atmospheric temperatures above freezing.

Since cooling towers usually operate continuously, it is during the winter months when the towers are operating at a reduced load that the lines are sufficiently dry for painting. Since the coating will likely be applied at subfreezing temperatures, some other material than zinc silicate must be used.

Table 1 shows that our material choice would be either phenolic or hot-spray vinyl with the latter preferred.

One exception in this selection chart is the application of high-temperature paints on hand-cleaned steel. These materials show good performance when applied directly on hand-cleaned steel. But, the use of primers and surface conditioning must be avoided.

Black and aluminum paints are our most durable and low-cost colors for atmospheric-corrosion protection. Colors other than these must be weighed on other merits.

TABLE 5—CASH-FLOW COMPUTATION
OPTION C VERSUS OPTION A
Investment — by going Cases 1 and 6 ($2,000 minus $2,000)
Cash flows — by going Cases 1 and 6 vs. Cases 1 and 5
Rate of return—5%.

After-tax maintenance savings	Amount	Interest at 5% — Factor	Interest at 5% — Present worth
End of fifth year	$(650)	.78	$(507)
End of eighth year	400	.67	268
End of eleventh year	400	.59	236
End of thirteenth year	(750)	.53	(397)
End of fourteenth year	400	.51	204
End of seventeenth year	400	.43	172
End of twentieth year	400	.37	148
End of twenty-first year	(750)	.36	(270)
End of twenty-third year	400	.33	132
Total present worth at 5%			$ (14)

Cost of Coatings

In the final analysis we must compute costs. Over-all costs may be subdivided into material cost and applied cost.

... For material costs purchasing departments must take into account such factors as technical assistance from the manufacturer's representative, and the amount of research done by the manufacturer, as well as the cost per gallon.

... Applied costs include scaffolding; surface preparation, labor, and materials; paint labor for surface treatment; paint labor for primers and top coats; cleanup; and overhead.

As exposure history is developed, the costs per square foot per year of service may be calculated from the data in Table 2. For an over-all evaluation of our plant painting program, we use total painting cost as a per cent of plant replacement value.

To compare costs, we use the principles of discount cash flow[1] to calculate the rate of return as shown by examples in Tables 3, 4, and 5. These examples compare the various painting methods which could be applied to two new 15,000-bbl. spherical tanks.

These two spheres have recently been erected in a heavily contaminated marine environment and painted as suggested in case 1, Table 3.

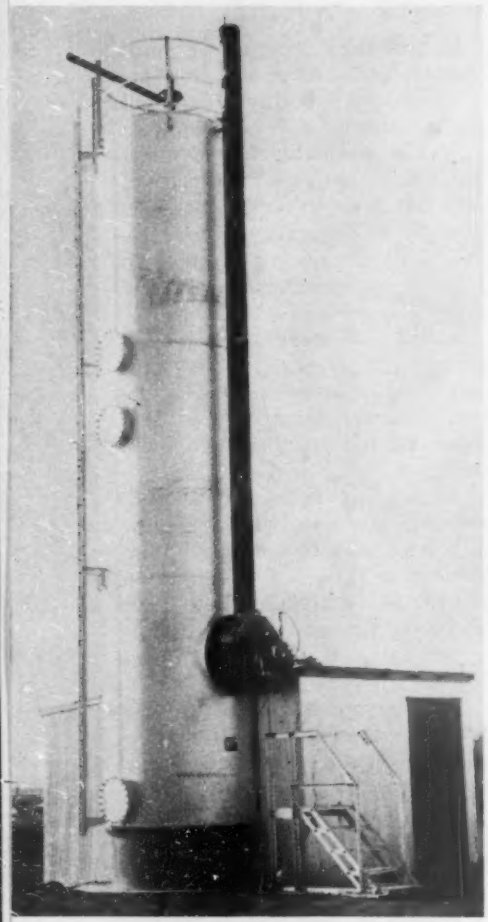
Since the square feet of surface are the same under any option, the before-tax cost per square foot per year of service is shown to be the least under either option A or C, Table 4.

The after-tax cost per square foot per year of service is approximately the same under any of the options. Since the decision on which option to choose is not clear-cut on the basis of cost per square foot per year of service, we were influenced by the 5% rate of return shown for option C. Cash-flow computation for option C versus option A is shown in Table 5.

We believe this illustrates an important concept in economic evaluation and demonstrates that coating materials may not be necessarily chosen for longevity.

Reference

1. Reul, Ray I., "Profitability Index for Investments": Harvard Business Review, July-August 1957, p. 116.

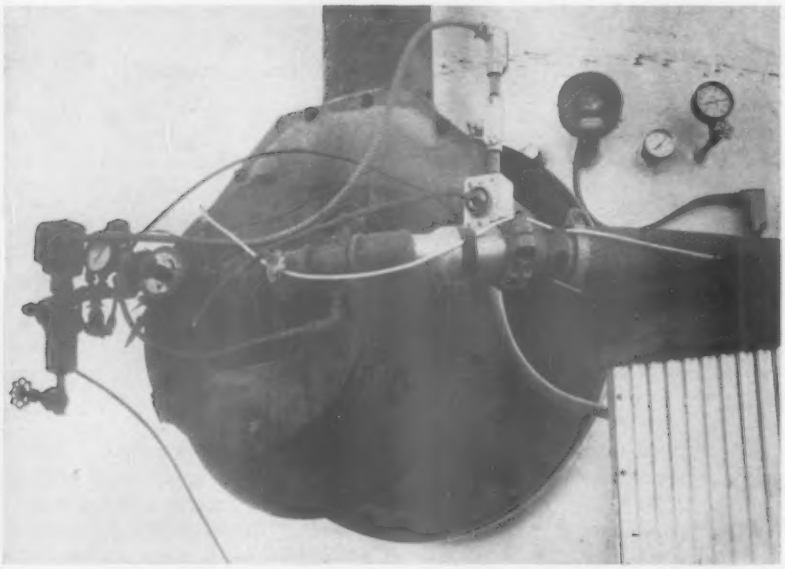


THIS TREATER, operating in Lindon field, Colorado, has been equipped to burn oil because of a scarcity of gas. Anderson - Prichard's conversion to an oil burner shows . . .

How to cut treating costs

BY W. B. BLEAKLEY
Production Editor

• In the Denver basin and other areas, the shortage of gas means buying LPG for firing treaters. Here's how one producer has cut this high cost of treating.



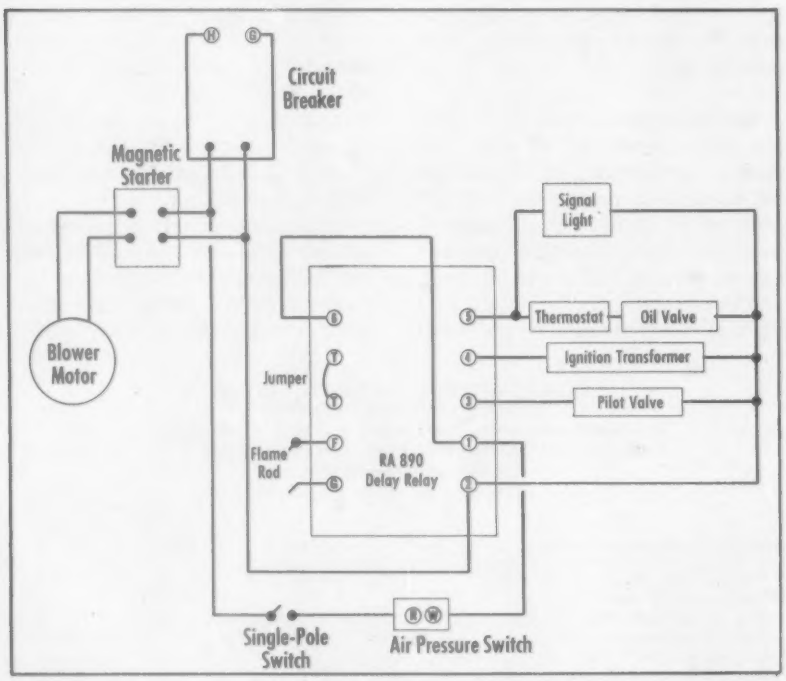
CLOSEUP OF burner shows pilot valve, left, with ⅜-in. copper tubing coming from bottom of photo; the oil valve behind the pilot valve, and the air adjustment control on the burner. To the right on the shell of the treater are the Mercoid thermostat, a temperature gage, and a pressure gage. The white line is the high-tension wire from the ignition transformer to the ignition plug.

A TOUGH treating problem has been licked on the Wright lease, Lindon field, Colorado.

And the cost is low, too.

Anderson-Prichard Oil Corp. engineers were faced with the problem of buying LPG to fire their heater-treater on the Wright lease in Washington County. Casing-head gas is in short supply in the field, and can't be relied on for treater fuel. Because of the expense involved with LPG, they decided to try using an oil burner. And they wanted it to be automatic.

What they did. Starting with a



CONTROL RELAY and simplified general wiring diagram. The air pressure switch isolates the control relay from the power supply as a safety feature in case of power failure. The flame rod must be hot (pilot light on) before oil valve will open. If pilot light goes out, it is automatically ignited, and once the flame rod reaches proper temperature, normal service is restored.

Bethlehem Wire Rope on 6,500-ft well in Central Oklahoma. At the time of the photograph, this exploratory well near Slaughterville, Oklahoma, was 6,500-ft deep, and drilling still was going strong. The operator, E. L. Oliver Drilling Company, reported outstanding service from Bethlehem 1 ⅛-in. Wire Rope—6 x 19 Form-Set, improved plow steel, with IWRC. Bethlehem Wire Rope is a quality rope in every way. That's why it enjoys a fine reputation for dependability in racking up the ton-miles.

Steel

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BETHLEHEM STEEL

BETHLEHEM STEEL

BETHLEHEM WIRE ROPE

BS&B 6-ft. by 27½-in. treater, they removed the gas burner and installed a Hauck oil burner. A pilot light fired by LPG was put in, along with a forced-draft blower, electric controls, and a thermostat.

The assembly is completely automatic. The burner is on or off, depending on the signal from the thermostat, and the unit is self-lighting in case of power failure.

What it costs. Equipment needed to make the conversion amounted to about $1,600. Installation was extra. The unit burns about 1½ bbl. of lease crude per day. At $2.80 per barrel, the fuel cost is about $126 per month. The pilot burns about $10 worth of LPG per month, and the electricity bill is around $20. This gives a total of $156 per month operating cost.

What it saves. Performing the same job with an LPG-fired treater would cost between $600 and $700 per month, according to the bills being met by offset operators producing at about the same rate. This means that Anderson-Prichard is saving $450 or more every month.

How it works. Lease crude has an API gravity of 23°, and is normally hard to treat. Treating temperature is 165° F. Production is at the rate of 600 bbl. of oil and 40 bbl. of fresh water daily with a gas-oil ratio of 12 cu. ft. per barrel. Treating chemicals are added to the crude at each producing well.

The oil burner uses lease crude right from the treater where it is at a pressure of 20 psi.

The blower is on at all times, keeping the refractory block cool when the burner is off. Driving the squirrel-cage blower is a 3-hp. electric motor. There is an air pressure switch in the electrical circuit that opens in case the air pressure falls off due to power failure. When power is restored, pressure builds up, and the remainder of the circuit is energized as the pressure switch closes.

Heart of the control system is a Minneapolis-Honeywell RA890E primary control relay. All power circuits except the blower motor go through this relay.

In normal operation, the system behaves like any other thermostatically controlled heating device. The temperature of the crude in the treater determines whether or not the oil valve is open or closed, but the flame rod at the pilot will ground the thermostat circuit in case of pilot failure.

In the event of power failure, the pilot valve, and the oil valve are closed.

When power is restored the blower motor starts up. The control relay is isolated from the system until air pressure builds up and the pressure switch closes. Then the pilot valve opens and current goes through an ignition transformer which supplies 6,000 volts to the igniter plug. When the flame rod shows that the pilot is ignited, the oil valve opens on demand from the thermostat, and an oil-air mixture is fed to the burner. A signal light on the control panel tells when the pilot valve is open.

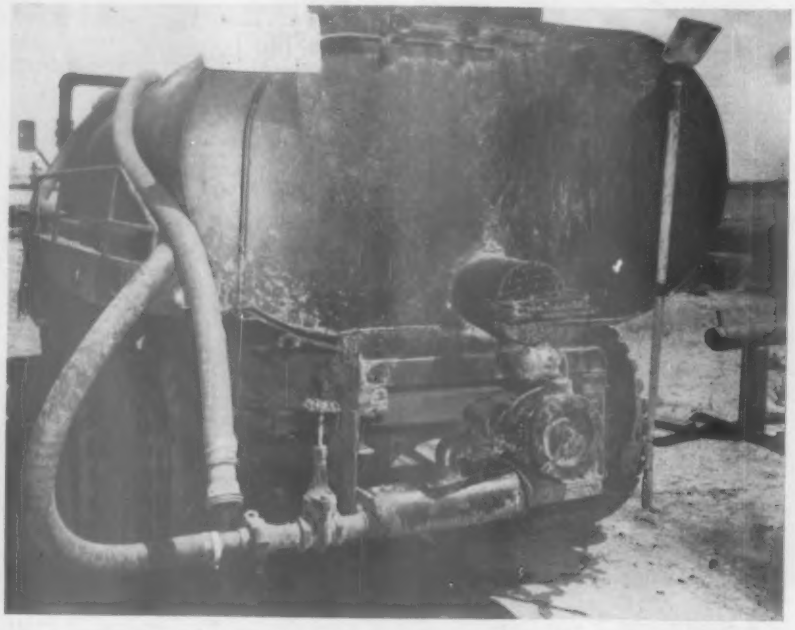
Disadvantages. While the oil burner is cheaper to operate than it would be with LPG, the system is not without some drawbacks.

The unit requires about 2 hours a week additional pumper time for maintenance.

Initial cost is higher than for a conventional gas-fired treater.

Unit will shut down in case of power failure. If pumping wells on the lease are electrified, this automatic shutdown is hardly objectionable.

More to come. This unit in Lindon field is more or less an experimental model and it took a lot of time to get all the bugs ironed out. But now that the treater is operating according to plan, Anderson-Prichard plans to use oil burners on other leases where gas is in short supply.



Transfer pump operates from power takeoff

HERE'S A SIMPLE WAY of hooking up a transfer pump on a truck that may be used to haul fluids for killing wells, fracturing, oiling roads, etc.

The pump is connected to the power takeoff which has been designed to handle the truck winch.

By mounting the pump to the right of center, it is convenient to connect up the bottom of the tank through a split union. The other end of the pump is connected to a strainer with a valve on the outlet. The hose is carried along the side of the tank and remains connected at all times. A strainer on the bottom of the tank and one between the pump and the hose protects the pump from foreign matter.

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THE EYES OF THE OIL INDUSTRY

There's good material and plenty of it in these packing elements. (Note the big holes—big because the packer bores are big and unrestricted.)

TWO BASIC MODELS

Model J (Product 756-J) is long-string set. Model K (Product 756-K) is short-string set. Both come with or without hold-down buttons (double or single grip). The picture shows double-grip Model J.

How to make a dual-string hookup that works

Required: a dual packer that works

NOTHING DEFEATS THE ECONOMICS of a dual completion like a dual packer that leaks. You must have a positive and dependable packoff.

It's fundamental—to make a dual string hookup work, you must have a dual packer that works, one that packs off and holds. That, many operators state plainly, is the reason they are using the new Baker duals.

WHAT MAKES THE PACKOFF SO POSITIVE? The reasons are designed into the simple and rugged 3-element packoff mechanism you see in the pictures.

There's been a lot of favorable comment on this design. It holds so well it doesn't need the non-retractable metallic back-up rings that so often stick to the casing and defeat retrievability. The 3-element concept came out of a tough proving ground. It was adapted from Baker's high-performance retrievable squeeze packers, proved in thousands of high pressure downhole operations.

BUT WHEN YOU'RE MAKING THE HOOKUP, you discover that while a positive packoff is essential, it isn't everything. You must have flexibility, too.

When you want to space out, to test packers before displacement—that's when you discover the importance of a packer that offers repeat setting.

A BAKER SNAP-SET DUAL is one packer that gives you both pressure holding power and flexibility. You set and pack off by setting down minimum weight—and the packer holds. You release by picking up.

It's just that simple. You don't pressure, you don't rotate, you don't drop balls—and you don't come out of the hole to re-cock.

You set and unset as many times as you need to. And when your hookup is made, you've got one that works.

BAKER
SNAP-SET DUAL PACKERS

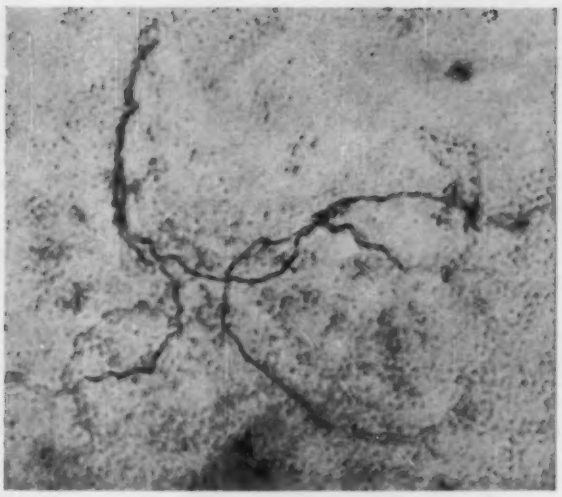
BAKER OIL TOOLS, INC.

HOUSTON LOS ANGELES NEW YORK

49 PAGES OF FACTS

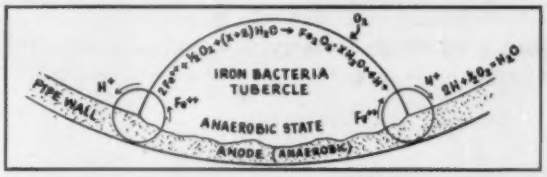
With big pictures and few words, a new brochure tells the interesting engineering facts about Baker's new Snap-Set Dual Packers. Get it from Baker representatives, or write to Baker Oil Tools, Inc., P.O. Box 2274, Terminal Annex, Los Angeles 54, California.

New type of iron bacteria found in salt water



THIS photomicrograph shows the Gallionella bacteria found in the Long Beach area. Fig. 1.

Previously believed to exist only in fresh-water systems, iron bacteria have now been isolated from salt-water source wells. This new type was found while investigating corrosive conditions in the Long Beach area.



THE CORROSION MECHANISM of Gallionella involves the building of a bacteria tubercle in which anaerobic conditions exist. Fig. 2.

BY J. M. SHARPLEY
Chief Microbiologist, Petroleum Section,
Buckman Laboratories, Inc.
Memphis

IRON BACTERIA (Gallionella) have always been considered a fresh-water bacteria, and their presence in salt-water-source wells has never been reported. But they have recently been found in water-source wells in the Long Beach area.

Severe corrosion. The large water-handling facilities for prevention of subsidence in the Long Beach, Calif., area have been troubled for years with moderate to severe corrosion. The corrosion had many of the characteristics of bacterial attack but routine bacteriological methods did not show the presence of bacteria. In spite of this negative evidence, corrosometer curves, Fig. 4, have the typical lag period followed by accelerated corrosion rate that is typical of bacterial attack. Coupon corrosion often showed deep pitting, Fig. 3. Equipment damage was also usually in the form of pit corrosion.

In the vicinity of Long Beach, there has been subsidence of the land bordering the sea, causing invasion of sea water into the former bed of the Los Angeles River. In recent years, there have been many water wells of approximately 150-ft. depth drilled into the river gravel stratum.

The water table in some of these wells rises and falls with the ocean tide, indicating free passage with the sea. The water produced from the wells approximates sea water in composition. From these wells, Gallionella are produced in very large quantities, causing operational difficulties and corrosion problems during the subsequent use of the water.

The possibility of accidental introduction of Gallionella into these wells has been thoroughly investigated and discounted. Within comparatively recent geologic time, the Los Angeles River deposited gravel in a wide area as the river meandered.

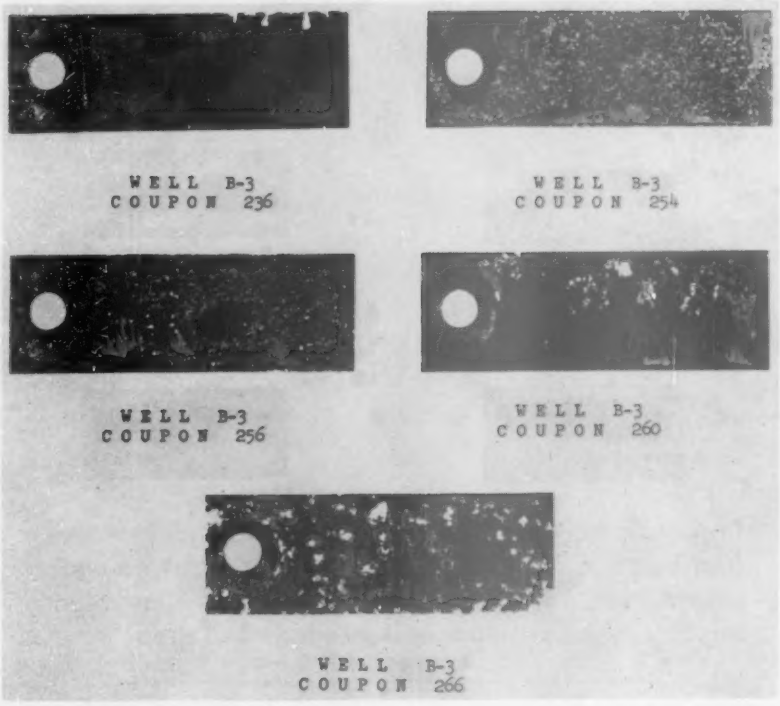
The area covered corresponds roughly to the Dominguez Gap. There are many water wells in this area and the subsurface geology is well known. Assuming that the river would deposit larger stones and boulders in the center and smaller gravel towards the shores, it is possible to choose wells spaced over the area of the alluvial bed.

As the tide rises and falls, there is a variable amount of fresh water in some of these wells. As might be expected, the greatest amount of fresh water occurs in wells at the edge and the landward end of the alluvial bed. If the Gallionella present had been introduced via the fresh water, greater numbers would be expected in the wells receiving the larger amounts of fresh water. Samples taken from wells spaced across the former bed of the river did not support this hypothesis. In fact, such samples indicated the heaviest concentration of Gallionella to be in wells receiving no fresh water discernible by chemical analysis.

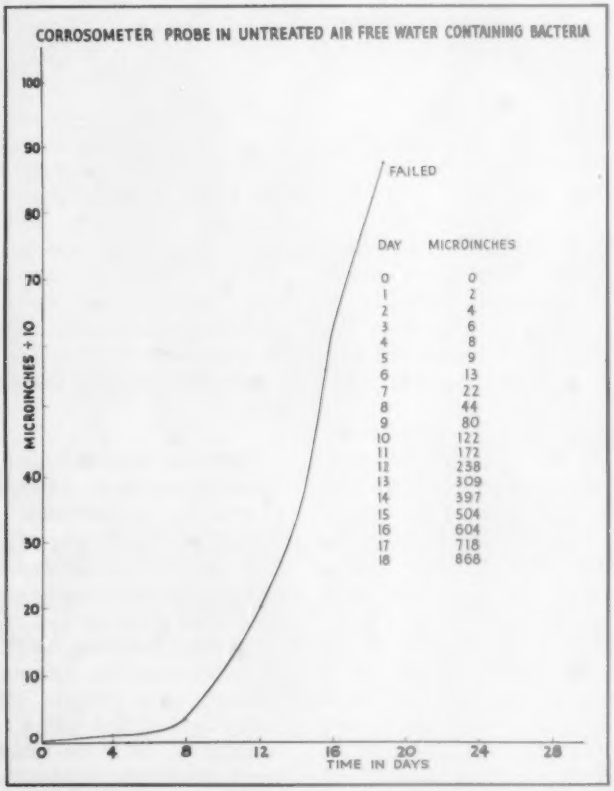
How they attack. Gallionella may cause corrosion in water-flood operations by two methods.

One of these involves the conversion of ferrous salts to hydrated ferric hydroxide providing anaerobic conditions at the bottom of the bacterial mass favorable for the growth of sulfate-reducing bacteria. In this manner, iron bacteria produce a bulky deposit that will often affect water flow, while the sulfate-reducing bacteria are responsible for the pit corrosion beneath the deposit.[1]

The second assumes that a small amount of ferrous salt is first formed



THESE COUPONS WERE PITTED SEVERELY in water-source wells. This type of corrosion is frequently found in water contaminated with bacteria. Fig. 3.



CORROSOMETER DATA from air-free Gaspur zone water, Wilmington field, California. This curve is typical for waters containing bacteria. Fig. 4.

by anodic attack, probably at some point where oxygen is depleted. The iron bacteria convert the ferrous salts to hydrated iron oxide. This material will then even more effectively shield the surface of the metal from oxygen so the attack becomes more and more vigorous as the result of differential aeration cells,[2] Fig. 2.

Both of these mechanisms may have contributed to corrosion by iron bacteria in the Long Beach area operations. It seems probable, however, that the bulk of the corrosion has been caused by sulfate-reducing bacteria growing beneath the deposits of Gallionella.

Aerobic or not? Gallionella cannot be cultured using normal techniques and thus have been previously overlooked in these water floods. They were detected on the surface of membrane filters examined microscopically and also by means of a specialized research technique developed for use in this area. The appearance of Gallionella in salt water is quite different from their morphology in fresh-water supplies. Fig. 1 shows the Gallionella isolated from the Long Beach area.

Gallionella have always been considered as aerobic bacteria but this is now open to some question. In the Long Beach area, the water-source wells characteristically contained less than 0.1-0.3 p.p.m. of dissolved oxygen, and iron bacteria were growing profusely in this water. The same phenomenon has been observed elsewhere.

Iron bacteria are one of the groups of microorganisms having considerable economic importance in the operation of water-flooding installations in the petroleum industry. They are a known cause of corrosion in fresh water and must now be considered as a source of trouble in salt-water supplies.

Acknowledgment

The writer acknowledges the assistance and advice of C. C. Wright, Oilwell Research, Inc., Long Beach, in the collection and interpretation of data reported herein.

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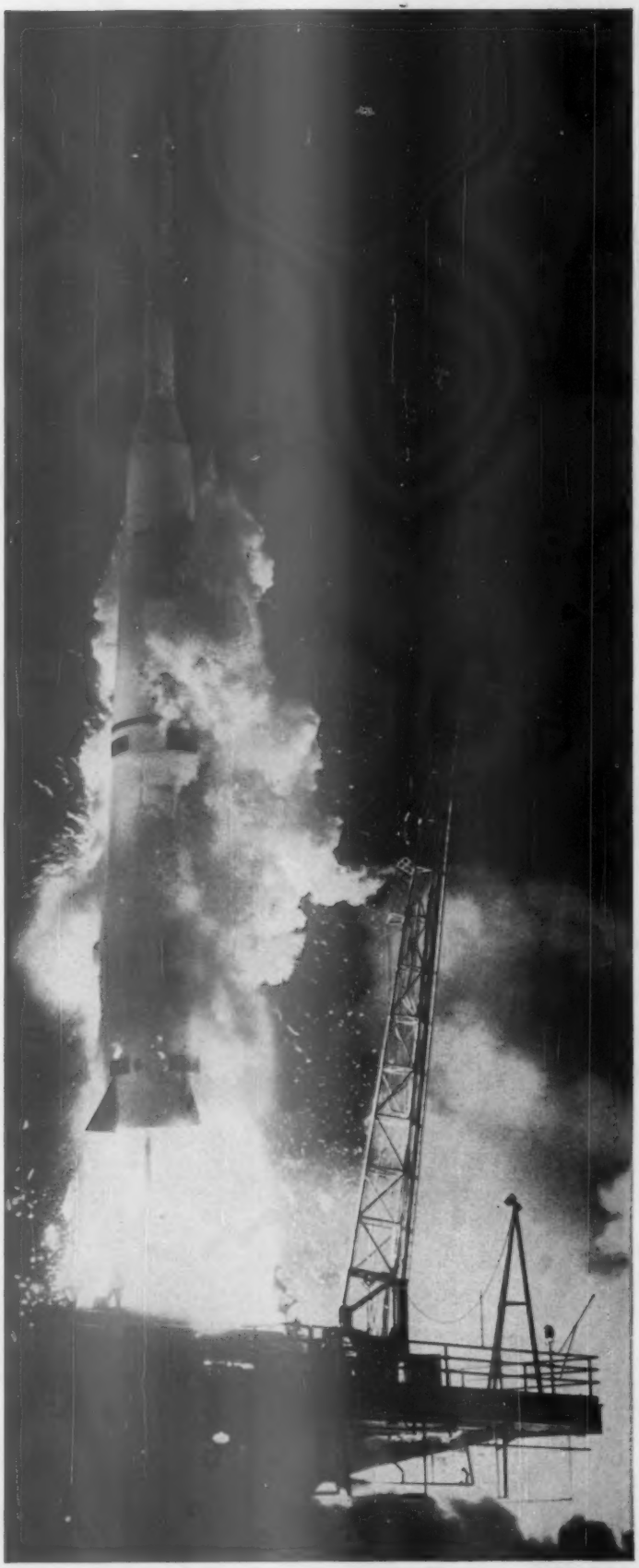

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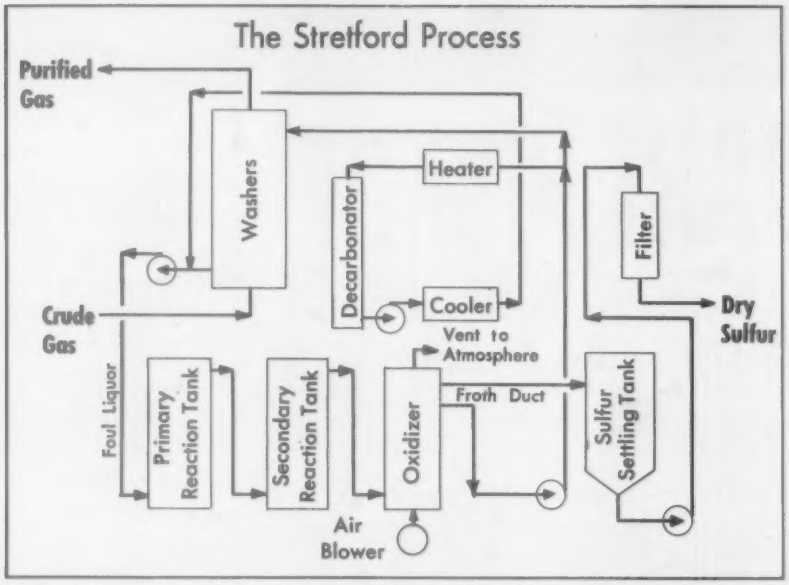


COMPACTNESS and simplicity of equipment reduce investment in the Stretford process to approximately half that of conventional processes.

BY HUGH S. PYLANT
Petrochemical and Gas-Processing Editor

THE STRETFORD process, recently developed by the North Western Gas Board and Clayton Aniline Co., Ltd., of England, has been successfully used in three installations to remove hydrogen sulfide (H_2S) and recover pure sulfur from various gases containing from 10 to 700 grains of H_2S per hundred cubic feet of gas.

Briefly, the process consists of washing the gas with a quinone solution, reaction of the H_2S to form sulfur and hydroquinone, oxidation of the hydroquinone back to quinone for reuse, and filtering to remove the free sulfur.

Laboratory tests indicate that this process is capable of treating gases containing as much as 50% carbon dioxide and H_2S, and produce a residue gas with only a fraction of a part of H_2S per million.

Investment and operating costs have been considerably less than conventional processes now in use.

Process. There are four steps involved in this purification method:

1. Sour gas passes upward through a washing solution in a packed tower. The wash, a 0.5% water solution of the sodium salts of 2-6 and 2-7 anthraquinone disulphonic acids containing sufficient sodium carbonate and bicarbonate to maintain a pH of 9, is sprayed into the top of the tower through a perforated pipe. H_2S is removed by the solution, and purified gas leaves the top of the tower ready for use.

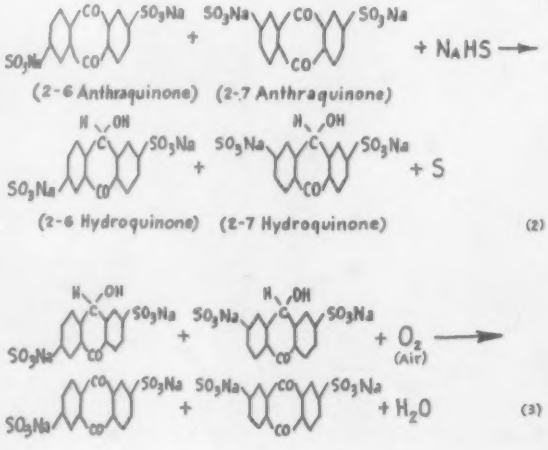
2. The H_2S-containing wash solution passes into a reaction tank which provides sufficient residence time to permit the H_2S to react with the carbonyl radicals of the quinone solution, forming free sulfur and the corresponding hydroquinone.

3. The solution is then pumped through injectors into an oxidation tower. The injectors add sufficient air to the solution to convert the hydroquinone back to the original quinone.

4. The reconverted quinone solution is put through a rotary vacuum filter to remove the free sulfur, and then is pumped back over the wash tower to begin another cycle.

The general reactions that take place in this process are:

$$Na_2CO_3 + NaHCO_3 + H_2S \xrightarrow{\text{(to maintain pH of 9.0)}} NaHS \qquad (1)$$



Economics. The first plant using the Stretford process went on stream in May 1959 processing an average of 3 M.M.c.f. daily of gas with an H_2S content of 700 grains. The annual costs of operating this plant run approximately $0.014 per M.c.f., taking no credit for the sale of sulfur and assuming that the wash reagent had to be replaced in 12 months. So far, there has been no indication that this reagent will ever need to be replaced.

Equipment, generally, consists of packed wash towers, a reaction tank, an oxidation tower, and a suitable filter. All of this equipment can be fabricated from ordinary carbon steel since there are no unusual corrosion problems to contend with.

In addition to the three Stretford units now in operation by the North Western Gas Board, the South Western Gas Board is presently converting three plants to the Stretford process. It is intended to put 10 M.M.c.f.d. of gas through each of these.

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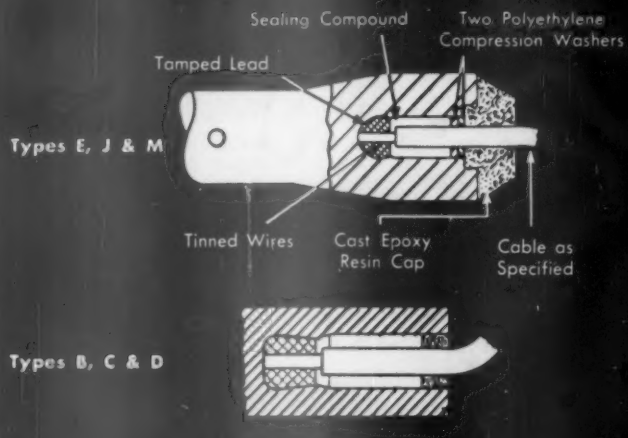

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D	2" x 60"	2.6	46	Ground Bed
E	3" x 60"	4.0	115	Salt Water
G	2" x 9"	0.4	5	Ducts
J	3" x 36"	2.5	80	Salt Water
M	2" x 60"	2.8	57	Salt Water

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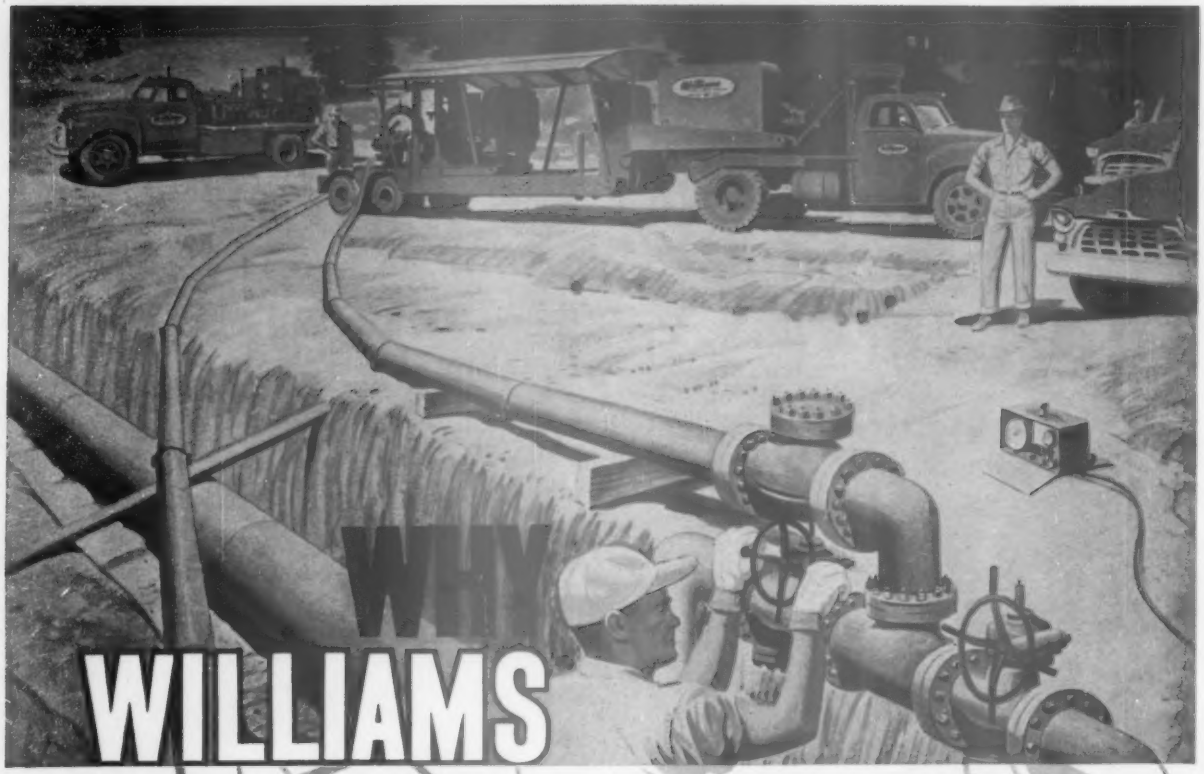

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A, B, C's of Regression and correlation analysis

The methods of statistics are uniquely fitted for the task of studying complex processes, and are powerful tools in the hands of the process engineer who will learn how and when to use them. Here's a brief look at two of these techniques.

WHEN A CUP of boiling water is poured over a tea bag and allowed to steep for 90 seconds, both the volume and strength of the resulting brew can be predicted with reasonable accuracy.

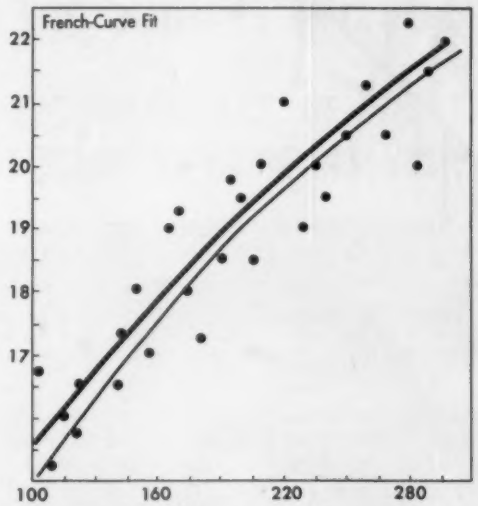
"Reasonable" accuracy is sufficient in this situation because the specifications on a cup of tea are seldom tight. Furthermore, tea making involves only three variables—time, temperature, and tea leaves—all of which can be held approximately constant, so little skill or know-how is needed to brew an acceptable cup.

In petroleum refining, however, prediction of yields and process behavior in general is a vastly more difficult problem. Here we are faced with processes involving dozens, or even hundreds, of variables, few of which can be directly measured or controlled.

Over the years a considerable body of empirical knowledge about these processes has been accumulated, with the result that most operations are probably run near optimum. Yet the incentive to do even better is strong, and efforts to improve are stimulated by the conviction that optimal modes of operation could be discovered and followed if more were known about the interrelationships of process variables. As long as the incentive exists, process studies will continue to be made to acquire new knowledge through which better predictions of process behavior can be made.

However, the kind of knowledge the engineer would like to have is, to a large extent, unknowable. It is unknowable because of the complexity and size of the processes

Adapted from a paper presented to a workshop session of WPRA computer conference, December 1960.



NO TWO PEOPLE will draw the same curve through a set of data points. Statistical analysis overcomes this difficulty. Fig. 1.

BY J. B. WILLIS
Computing Department
Phillips Petroleum Co.

with which he deals, because of inaccuracies inherent to the measurements and observations he takes, and because of variables whose presence or importance is unsuspected. In short, the process engineer spends much of his time working in the realm of uncertainty.

Fortunately, this realm of uncertainty exhibits the same basic orderliness and stability which exists throughout the physical world, and the patterns of process variability can be examined, manipulated, and eventually understood if the proper statistical methods are applied.

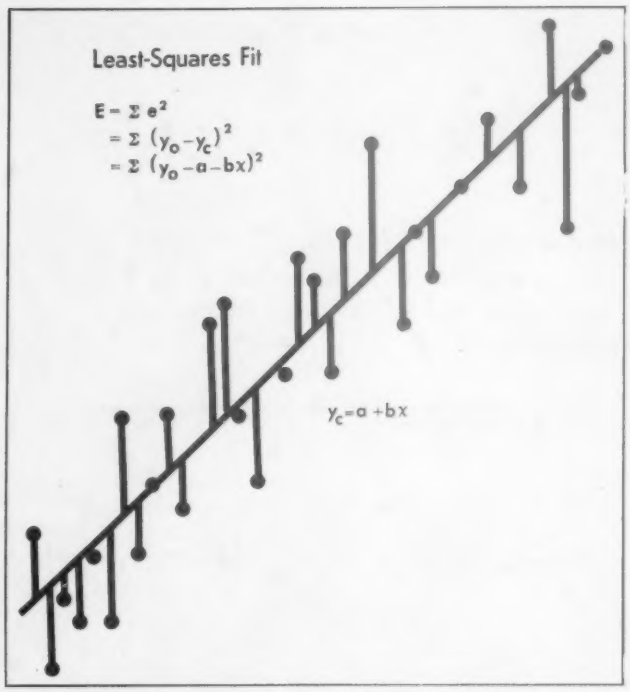
Let's consider one of the common devices for predicting process behavior. Say, for example, that you want to predict the yield of a motor-fuel component, based on total charge to the process unit. Data involving a suitable range of total charges are plotted on a sheet of graph paper and "fitted" by laying a French curve through the points. The result is a simple curve which can be used to predict component yield, knowing total charge to the unit.

Such curves are useful, but the procedure for generating them carries with it certain inherent weaknesses.

For example: No two people will draw exactly the same curve to represent the data (Fig. 1); there is no criterion for identifying the "best" curve. There is no measure of the precision of inferences based on the curve, and the graphic analysis is limited to three dimensions, or variables.

To account for the ability of regression analysis to overcome these weaknesses, it is necessary to introduce some of the basic concepts—and, unfortunately, some of the special terminology—of statistics.

The first of these, the **arithmetic**



LEAST SQUARES FIT involves finding the best values for a and b, so that the sum of the squares of the deviations of the observed y values from the proposed curve shall be a minimum. Fig. 2.

average, is probably familiar to everyone. Given no knowledge of a process except what can be inferred from a set of data on the daily yield, or output, the best value to take as a prediction of tomorrow's yield is the arithmetic average of the data at hand. (This statement assumes there is no trend upward or downward revealed in the data.)

True, a lucky guess of a high yield or a low yield might hit the mark on a given day; but in the long run, predictions based solely upon the average will deviate less from the actual yield than predictions which rely on luck.

Of course, the average yield computed from a sample of 20 or 30 observations is only an estimate of the **true average** yield. The true average is one of the unknowables. To find its value would require knowledge of the yield for every day the process had operated and would be operated in the future. If all those values were available, they would comprise something called the **population**—in this instance the population of daily yields from one process.

Since it is impossible to discover the value of the true average or mean, the statistician uses the biggest set of data he can get to compute an average which he then offers as the **expected value,** or the best estimate, of the true mean.

The same set of data gives information about the spread or overall variability in daily yields, and the particular statistic to compute for this purpose is called the **standard deviation** (s.d.). If X_i represents any observation, X' is the average yield and N is the number of observations, then standard deviation =

$$\text{s.d.} = [\Sigma (X_i - X')^2/(n-1)]^{1/2}$$

Once again, this is not the true standard deviation of the population but merely the best estimate.

Does s.d. add anything to our knowledge of the population of yields; does it add to the precision of our forecast of tomorrow's yield? The relationship between the mean, X', and s.d. is such that $X' = 1$ (s.d.) takes in the central 68% of the sample yields; $X' \pm 2$ (s.d.) takes in 95% of the sample yields.

Now by introducing a multiplier, $t_{0.05}$, which adjusts for sample size, we can say that tomorrow's yield will lie in the range $X' \pm t_{0.05}$ (s.d.), with 95% confidence that the prediction will not be wrong. The procedure of using a measure of variability in combination with an adjustment for sample size to arrive at tolerances for the estimate (called **confidence limits** by the statistician) is a powerful tool in coping with the unknowables.

Refining the Prediction

In most cases the mean, or average, is not sufficiently accurate to serve as a useful predictive tool. It then becomes necessary to attempt to explain the variation in the yield in terms of the change in other variables. Ideally, we would write an equation, based on the physical laws at work in the process, such that the yield is predicted in terms of the basic variables which are causing the yield to change.

If the knowledge of the process is sufficiently complete to permit writing an equation which embodies the physical laws governing the process, then the problem reduces to one of testing the hypothesis implied by the equation.

Regression analysis is, fundamentally, an hypothesis-testing method. Stating this another way, regression analysis enables the investigator to substantiate—or to reject—a statement of theoretical relationships.

The question to be answered is: Can coefficients be determined for an equation of a specific type such as $y = a_0 + a_1x_1 + \ldots + a_nx_n$ so that it adequately represents the process? Regression analysis calculates the best set of constants (coefficients, exponents, etc.) for the equation using Gauss' familiar "principle of least squares," determines the per cent of the variation in yield that is explained by the equation, and establishes the precision of the equation in terms of the standard error of estimate.

As the example showed, when nothing is known except the history of the yield, the best predictor

"A lucky guess of a high yield or a low yield might hit the mark on a given day; but in the long run, predictions based solely upon the average will deviate less from the actual yield than predictions which rely on luck."

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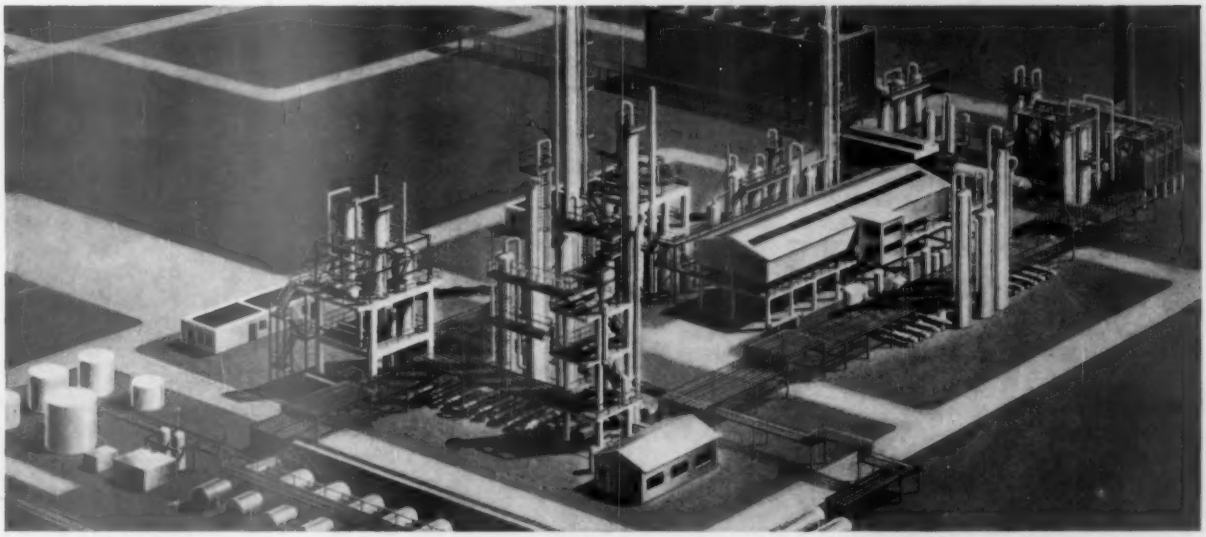

The Lummus Company has been awarded the contract to design, engineer and construct a $20 million ethylene and ethylene oxide plant for SunOlin Chemical Company at Claymont, Delaware.

The plant is scheduled to go on stream late in 1961, and will have a design capacity of 225,000,000 lbs. of ethylene and 55,000,000 lbs. of ethylene oxide per year. Existing facilities will be modified to permit production of 12,000,000 cubic feet of high-purity hydrogen and up to 1,000,000 cubic feet of carbon monoxide per day.

The new units will be located at Claymont, Delaware, adjacent to the Sun Oil Company's Marcus Hook Refinery which will supply the raw material for the plant.

A substantial portion of the products produced will be used to supply the requirements of major chemical companies in the area. To permit efficient delivery of ethylene and other petrochemicals, a multiple pipe line crossing will be laid under the Delaware River from the site to serve customers in the expanding Southern New Jersey industrial area.

The remainder of the production will be used in the manufacture of products marketed through existing sales outlets of Sun Oil Company and Olin Mathieson Chemical Corporation, the joint owners of SunOlin.

The plant will employ Lummus' low-temperature ethylene separation process, which provides high separation efficiencies and unusual flexibility and reliability; and Shell Development Company's ethylene oxide process, which offers the advantages of unusually high yields and virtual elimination of waste disposal problems encountered in the classic Chlorohydrin Process.

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"It should be pointed out that the criteria for a 'best' estimate are that they be unbiased, and to be more efficient than other possible estimates."

is the average, or mean, value of the yield. When information of other variables is added, then the original set of yields can be divided into groups with each group corresponding to a specified value for each independent variable. Thus, the population of daily yields is now a series of populations: one population for each set of values of the independent variables. Just as the mean was the best predictor in the one-dimensional case, the mean of each population is the best estimate in the multidimensional case.

It should be pointed out that the criteria for a "best" estimate are that they be unbiased, and be more efficient than other possible estimates. An unbiased estimator is one that tends to cluster about the true value whose estimate is sought.

In other words, the average value of many estimates tends to equal—rather than consistently understating or overstating—the true value. An efficient estimator is one which yields nearly the same value most of the time; or, the s.d. of the estimate is much smaller than the s.d. of the original population.

Thus, the desired predictive equation has its constants determined so as to pass the curve through the expected mean for each set of values of the independent variables. It can be proved that Gauss' principle of least squares determines constants that satisfy this criterion: the equation predicts the average of the population for each combination of x's.

Minimizing Prediction Error

The principle of least squares states that the best coefficients are such that the sum of the squares of the deviations of the observed y values from the y values calculated from the regression equation shall be a minimum (Fig. 2).

To show this, let's examine a simple equation of the form $y = a + bx$. In this case the error function (sum of squares of deviations), E, will be:

$$E = \Sigma[y_o - (a + bx)]^2$$

where y_o is the observed value of y.

To minimize this function, the partial derivative of E is taken with respect to each equation constant: $(\delta E)/(\delta a)$, $(\delta E/\delta b)$ and each partial derivative is equated to zero (Fig. 3). These equations, known as **normal equations,** can be solved simultaneously for the best estimates of the equation constants.

The result is the equation of the specific curve which fits the data in accordance with the least-squares criterion. If the equation constants are linearly related, the method of solving the simultaneous equations is straightforward. If they are not linearly related, an iterative procedure is usually required. This discussion will consider only the linear case.

At this point we have the "best" or least-squares curve fitted to the data. Now it remains to test this curve for adequacy as a predictive tool. However, since the best set of coefficients has been obtained, it follows that any further improvement can be obtained only by adding other variables and/or some alternative functional forms of variables, or by increasing the precision of the measurements.

The equation is usually tested by the standard error of estimate, a measure of precision, or by the coefficient of determination, a measure of the amount of variation in y that is explained by the independent variables which comprise the right-hand side of the equation.

The standard error of estimate (s.e.e.) is a measure of the expected dispersion of observed values of y about the regression line. In the multidimensional case the s.e.e. is roughly comparable, at the mean of the data, to the standard deviation in the one-dimensional case. If the s.e.e. of y is not considerably smaller than the standard deviation of y, then the equation is not much better than the mean of y as a predictive tool.

The added complexity of the equation is justified to the extent that predictions based on the least-squares curve are more precise than those based solely upon the mean value of the raw yield data. How much improvement in precision must be achieved before the added work of regression analysis is justified is a question of economics and judgment.

The precision of an estimate is a function of knowledge available. Therefore, since the mean may be regarded as the arithmetic center of the available knowledge, it is to be expected that the predictive equation will be most precise at the mean of the data.

Confidence limits can be calculated for each point along the regression line, thus delineating an area in which one can expect most observed values of y to fall. In general, confidence limits form an hourglass-shaped curve which is narrowest at the mean of the data. Formulas for calculating confidence limits are given in most of the texts listed in the bibliography.

Another test of adequacy of an equation is found in the coefficient of determination. This coefficient (the square of the correlation coefficient, R) states the fractional portion of the variation in y that can be explained in terms of the variation in the x's. Thus, an R^2 of 0.94 indicates that the equation will predict about 94% of the variation of y.

Whether the increase in R^2 caused by adding a variable to the equation is relevant or not will depend on the amount of variation already explained.

A certain variable, for example, might be tested and found to be statistically significant. It might be shown that the inclusion of this variable increases R^2 by 0.05. Any variable which contributed only 0.05 to R^2 probably would not be

NORMAL EQUATIONS

$$E = \Sigma(y - a - bx)^2$$

$$\frac{\partial E}{\partial a} = \Sigma -2(y - a - bx) = 0$$

$$\frac{\partial E}{\partial b} = \Sigma -2x(y - a - bx) = 0$$

OR

$$Na + b\Sigma x = \Sigma y$$

$$a\Sigma x + b\Sigma x^2 = \Sigma xy$$

NORMAL EQUATIONS are solved simultaneously to get the best estimate of the equation constants. Fig. 3.

The Honeywell Control Valve (foreground) regulates flow of Bunker C fuel oil burner in a chemical process drying system. In the background, a Honeywell diaphragm actuator operates a damper for control of hot air return. Nothing spectacular going on here, but the results of the entire process could well depend on these valves.

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considered relevant if the previous R^2 was below 0.50 or 0.60, whereas one might consider himself extremely fortunate to find such a variable if the previous R^2 was 0.92 or 0.93.

The assurance with which a regression equation can be extrapolated is a function of the theoretical exactness of the equation. Confidence limits are meaningless when calculated for values of x outside the range of data used to determine the equation.

Correlation Analysis

The preceding discussion has assumed the existence of an equation to test. Unfortunately, there may not be enough information available about a given process to formulate such an equation. In this situation, regression methods are useful in curve-fitting the yield, but the resulting equation is not a true regression equation.

Where the objective is to obtain a curve fit to a set of data, the analysis tests the hypothesis: Is this an adequate approximation to the theoretical equation in this region? It does not answer this question: Does experimental data substantiate this equation? It is dangerous to extrapolate such response surfaces beyond the bounds of experimental data because they make no pretense of satisfying the existing physical laws.

The procedure for generating response surface equations is: By use of correlation analysis, ascertain which variables have a significant effect on the yield, then use regression analysis on the variables found to be significant to see if an adequate approximation can be obtained. This procedure frequently provides a useful predictive tool for a limited region, and is a convenient stepping stone toward development of a better mathematical model.

Regression analysis selects the best parameters (coefficients) for a specific mathematical model, and measures the precision of that equation; whereas correlation analysis is used to determine whether or not any significant relationship exists.

Some statistics estimated by correlation analysis are: simple correlation coefficients (r), multiple correlation coefficients (R), and coefficients of determination (r^2 or R^2).

"The simple correlation coefficient is a quantitative estimate of the direction and magnitude of the relationship between two variables."

The simple correlation coefficient is a quantitative estimate of the direction and magnitude of the relationship between two variables. It can vary between -1 and $+1$. An increase in the degree of relationship is indicated by an increase in the absolute value of r. The sign indicates the direction of the correlation.

The multiple correlation coefficient varies between 0 and $+1$, and is a quantitative estimate of the relationship between a dependent variable and a system of independent variables.

If the independent variables are truly independent, then R^2 is the simple sum of the r^2's. However, this situation is rare in practical problems. More generally, because of the correlation between the independent variables, the sum of the r^2's is considerably larger than R^2.

The coefficient of determination is the square of the correlation coefficient. It gives an estimate of the amount of variation in one variable than can be explained in terms of the other variable. However, this "explanation" of variability does not imply a causal relationship. Either variable may be the cause, and the other the effect; or both may be the effect of some third, as yet unknown, variable.

Thus, correlation analysis assists in determining the significance of a relationship between two variables, or between a variable and a system. Reasons why the relationship exists (whether spurious, causal, or effect of some unknown variable) cannot be determined from the mathematics.

Regression analysis tests the appropriateness of a particular mathematical model in terms of the coefficient of determination, R^2; selects the best estimates of the equation parameters for predicting the mean of the y values for each set of x's, and gives the precision of these estimates as well as the precision of the predicted y-value.

The same mathematical techniques are used to calculate the correlation coefficients as are used in regression analysis. The correlation coefficient can be calculated from the formula:

$$r_{1,2} = \frac{\Sigma(x_1 - x_1')(x_2 - x_2')}{[\Sigma(x_1 - x_1')^2 \times \Sigma(x_2 - x_2')^2]^{1/2}}$$

$$= \frac{Cov_{1,2}}{(Var_1 \times Var_2)^{1/2}}$$

If a normal equation is solved for a_o, and the resulting expression substituted for a_o in the remaining equations, then the resulting equations have variances and covariances as coefficients of the unknown equation parameters.

The difficulty in solving the set of normal equations consists of the sheer magnitude of the task when several (more than 5 or 6) equations are in the set, or when one equation is almost a linear combination of one or more of the remaining equations.

The second source of difficulty, dependence among the equations, can be eliminated by using experimental designs while gathering the data, thus making the correlation coefficient between independent variables equal zero. The first source of trouble, the number of calculations necessary to solve a large set of equations, has been reduced, but not eliminated, by electronic computers.

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Fibercast flow line suspended by cable 900 feet from well to tank battery. Typical application of Fibercast because of its light weight, superior beam strength and resistance to elements.

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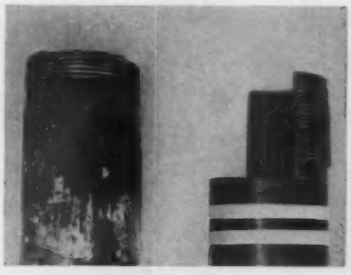
Because it is not subject to cold flow or permanent set, Fibercast is remarkably easy to install. It readily follows ditch contours, saving costly manhours where other non-metallic or coated metal pipes simply are not suitable. Moreover, Fibercast's operating collapse strength, an important factor in installation design, is capable (based on long-term testing) of sustaining a collapse load of *twice* the rated collapse.



Fibercast Tubing (right) used to suspend a 1,200 lb. pump for 3 years in a salt water supply well. *There was no loss in strength.* The damaged plastic-coated steel nipple (left), was used in the same installation, failed after 3 months' service.

Its linear coefficient of thermal expansion (7.06 X 10^{-6} to 8.25 X 10^{-6}. in./in./ °F.) is essentially the same as that of steel. But Fibercast is much lighter than steel, (less than ¼ its weight), and is correspondingly easier to work with. Yet, because of its strength, Fibercast can even be installed on pipe racks with span lengths normally used for metal pipe.

Fibercast has been tested in 338 common corrosive solutions and competently handled 320! Actual installations in the oil fields have revealed Fibercast's effectiveness against corrosion, contamination, abrasion, scaling and paraffining. Used as a flow line . . . in a salt water disposal well . . . or as shot hole casing, Fibercast performs better, lasts longer, costs less.

Fibercast Fittings are a "must" in oil country, too. Besides the ready availability of the world's most complete stock of standard sizes and types, you can have couplings designed and made to order for individual requirements.

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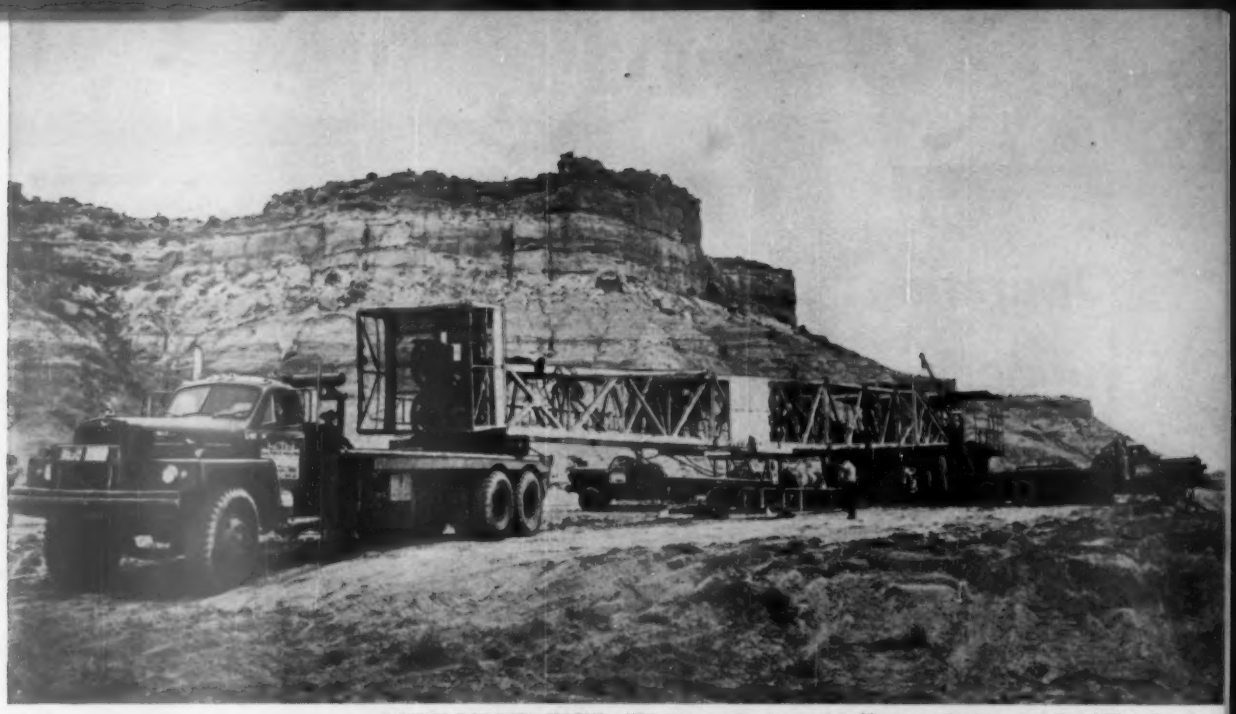

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Earning dependable profits in oil-field hauling depends in good part on using the most dependable trucks. Alton H. Lee, Inc., oil-field transporter of Farmington, N. Mex., has experienced unequaled vehicle earning power since its first purchase of Macks in 1955 and now operates a predominantly Mack fleet.

"Our Thermodyne® diesel-equipped Macks operate up to 36 hours on only 90 gallons of fuel, hauling 100-barrel oil and water tanks over some of the roughest terrain in this part of the country. And in winter they cost us as little as $100 a month maintenance," says Mr. Alton H. Lee, company president. "I call that economy!"

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For trucks that can make more money for you, take a leaf from the books of operators like Alton H. Lee, Inc., whose performance records prove that Macks are consistently top earners. Your Mack branch or distributor will gladly supply facts and figures. Mack Trucks, Inc., Plainfield, New Jersey. Mack Trucks of Canada, Ltd., Toronto, Ontario.

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The FOREMAN'S PAGE

Operating refinery furnaces

PART 4—COMBUSTION

Because the heat requirements of the process which the furnace serves will vary, the amount of fuel and combustion air must be regulated to meet these fluctuating requirements. The amounts are regulated by combustion controls.

In most process furnaces, the coil-outlet temperature of the liquid being heated is the controlling point. The amount of fuel fired is automatically controlled to hold a preset coil-outlet temperature. This is done by an air-loaded valve, usually located in the gas header which feeds the burners. This valve is a pressure-open type so that, if there is an air failure, the valve will automatically shut off the gas.

Probably the largest controllable factor that causes poor efficiency is the use of too much combustion air. About 15 to 20% excess air should be adequate to provide complete combustion. Any additional air is merely heated and discharges to the atmosphere with a resultant waste of fuel.

Fig. 5 shows how too much combustion air will cut furnace efficiency.

In most furnaces there are three points of control on combustion air.

1. Primary-air shutters on the burner.
2. Secondary-air doors on the burner.
3. Furnace damper.

Air shutters on the burner control the opening through which the primary air must pass. These shutters are the basic control for air to the furnace, especially when burning gas.

Secondary-air doors control the amount of secondary air to the furnace. When too much air is being supplied to a furnace, it's the secondary air, usually, which should be reduced.

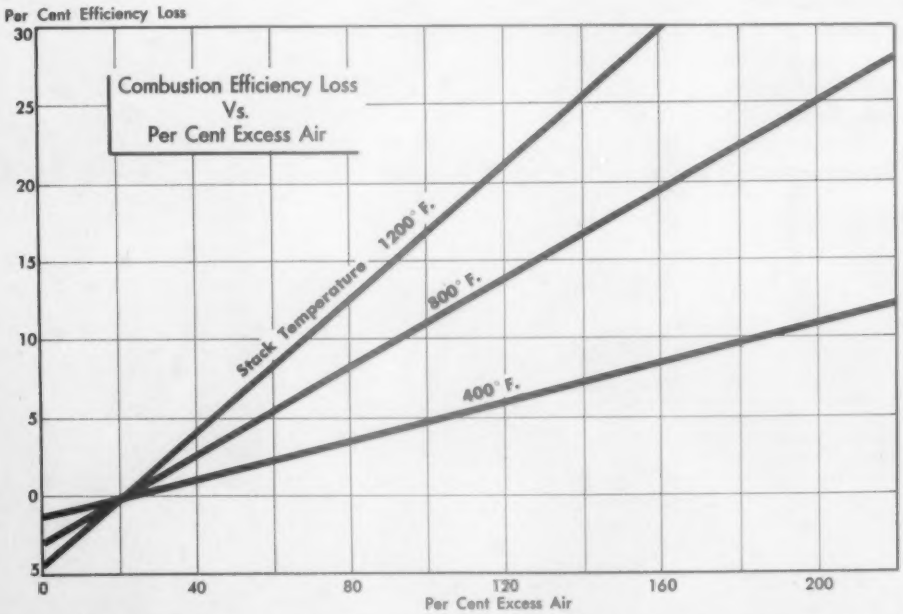
The furnace damper is the valve which controls the rate at which products of combustion leave the furnace. If this damper, located in the stack, is set in a nearly closed position, it tends to hold back the flow of hot gases to the air, and raises the furnace pressure. Any rise in furnace pressure means less primary and secondary air can get in. Keep in mind that opening the damper will increase air; closing it will decrease air.

Furnace Operation

In a fire box the flame from a gas should be blue or blue with small flecks of yellow. An oil flame should be a clean yellow color. These colors represent good combustion.

- Any smoke in the fire box should be avoided. This is evidence of incomplete combustion. Long "hazy" yellow flames which may be impinging on the tubes are excellent indicators of poor combustion.
- Brick work should have a uniform color. If you look inside a furnace, sometimes you may see extremely hot brick work or tube hangers. Many times these are indications of poor flame distribution.
- Cherry-red spots on tubes are often an indication of localized overheating. However, care and experience are required in such observations. Many times what appears to be a hot tube may only be incandescent scale on the tube surface.
- All refractory should be in first-class condition. Any loose rubble or broken brick laying on the furnace floor may become a flame target and result in poor heat distribution. During turnarounds care should be taken that floor bricks are not installed too tightly; expansion after startup will cause the floor to buckle.
- The convection section should be clear with maybe a wisp of smoke coming in from time to time. This is a sign of efficient combustion.

This material taken from process-training-program manual, Bayway, N. J., refinery of Esso Standard Division of Humble Oil & Refining Co.



WHEN MORE than 20% more air is used than that theoretically required to burn the fuel, furnace efficiency is reduced. Fig. 5.

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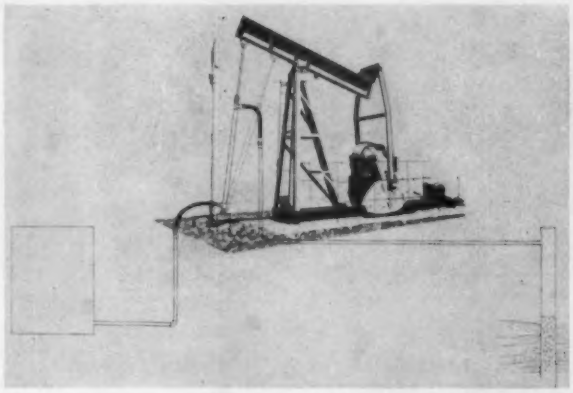
▶▶▶ New Equipment Section

This week's SHOWCASE features . . .

New help for salt-water disposal

. . . is offered by the new pump which can be used at the present pumping oil well with the walking beam. The pump is powered by the walking beam, as is the downhole pump.

All parts are conventional working plunger and barrel types. The maker says the pump can create pressures up to 2,200 psi. Dimensions: 1½ in. by 4 ft. Suction stroke: 8 to 20 in. Pumping speeds: 10 strokes per minute with 52-bbl. capacity and 20 strokes per minute with 105-bbl. capacity. Pump materials, brass or Ni-Bral.



Pump installation is relatively simple. Weld the upper anchor nut to the walking beam and the lower anchor onto the casing lead or casing clamps. Then attach the pump with a ¾-in. API Standard threaded retainer into the lower anchor. Next adjust the walking beam or weight to balance the load. The pump is then ready to use.

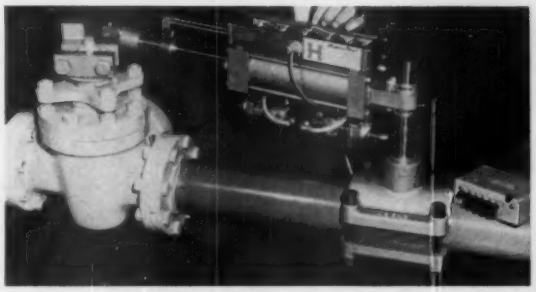
Besides salt-water disposal, anticipated uses for the pump include pipeline pumping, and circulation wells and tanks. Source: **L & W Co., P. O. Box 724, Salina, Kan., U.S.A.**

Valves controlled remotely

. . . with a new electrical-mechanical servo device called the Hanna-Powr positioner, which is available. According to the maker, the device automatically positions valves or floats at any of several predetermined positions corresponding to a control selector-switch signal.

The multiple-positioning control can be used with various types of power mechanisms, including air or hydraulic cylinders, and solenoid valves, to operate pipeline flow valves. An operator can turn or press the position-selector control switch in the pipeline control office to cause a valve, miles away, to open or close at any of several selected positions. A return readout signal light indicates when the valve reaches the predetermined position.

The Model PR2A has two cam rods. A connecting link on one end attaches to the mechanism which the positioner controls. The other two ends of the cam rods trip limit switches as the cam rods slide back and forth inside the two channel grooves in the extruded-aluminum



positioner housing. The unit may have as many as 14 sets of limit switches per foot. This means up to 14 positioning stops per foot in the positioner. The positioner may be made in lengths up to 8 ft. as stand-

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ard which means up to 112 positioning stops. Source: **Panna Engineering Works, 1765 Elston Ave., Chicago 22, Ill., U.S.A.**

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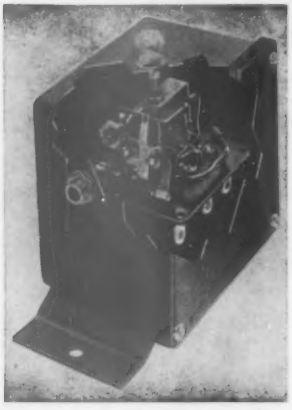

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Centralizer

. . . design improved to reduce frictional drag and provide better self-cleaning properties. The Spiral-Flo centralizer uses a spiral type of construction to divert or whirl cement and help break up channeling. The new model is designed to run in close tolerances. Source: **Weatherford Oil Tool Co., 5920 Navigation, Houston 11, Tex., U.S.A.**

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New Equipment

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. . . now being produced is this high-temperature, programed column gas-chromatography accessory unit, the Model 22. It is reported to provide programed column operation from ambient temperature of 930° F. for existing chromatographic units that do not now have column programing.

This accessory is built with a split-flow system that uses two columns: a reference column and a sample column. The sample column connects to the gas-chromatograph sample-detector cell. The other one connects to the reference-detector cell. A cam type of programer is used for the column temperature. The maker says the balance system compensates for the background vapor pressure of the column packing during programing. Source: **Loe Engineering Co., 2092 N. Lincoln Ave., Altadena, Calif., U.S.A.**

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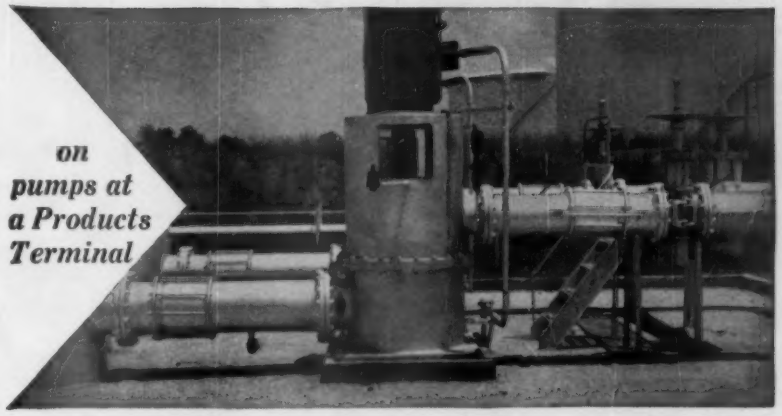

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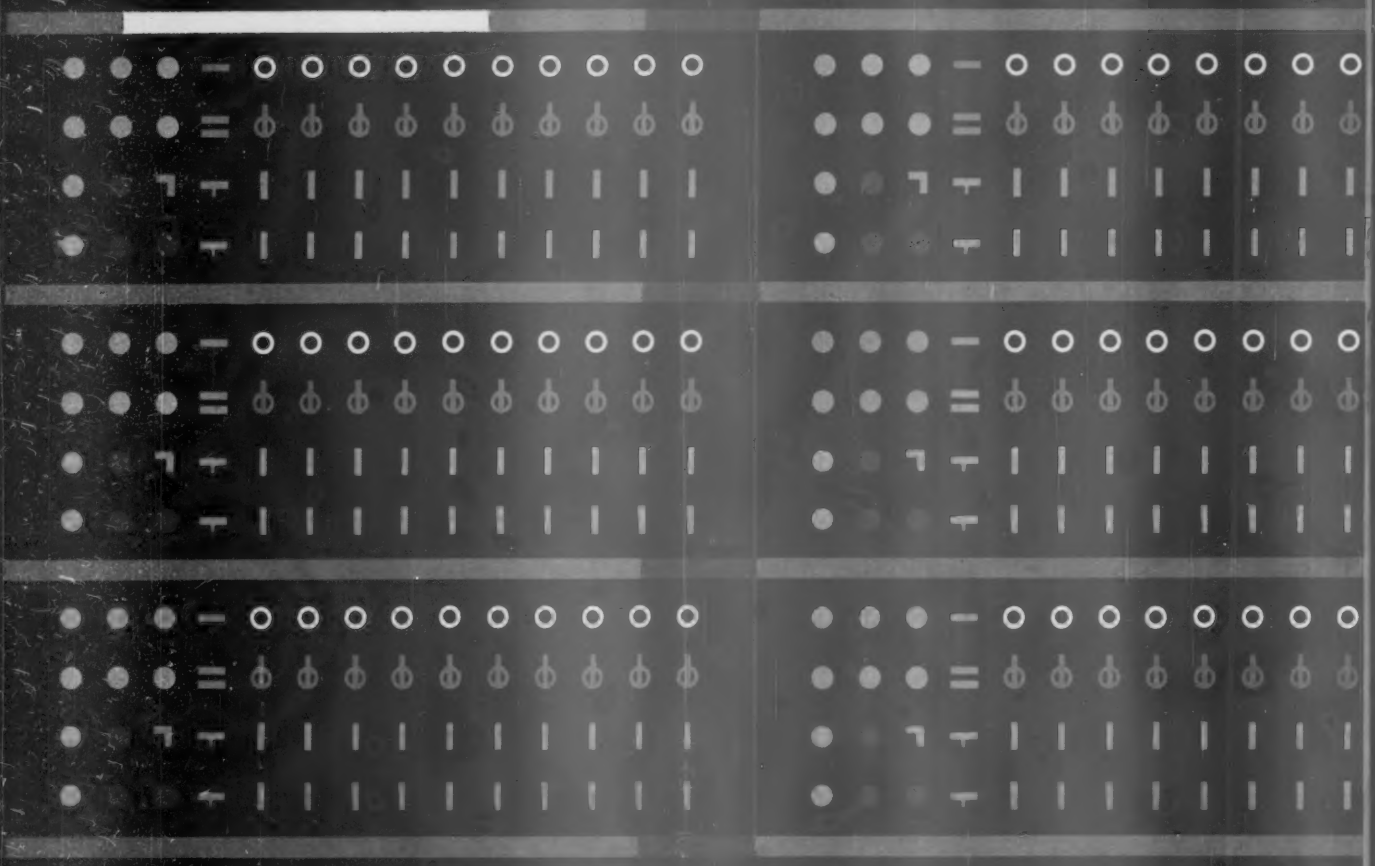

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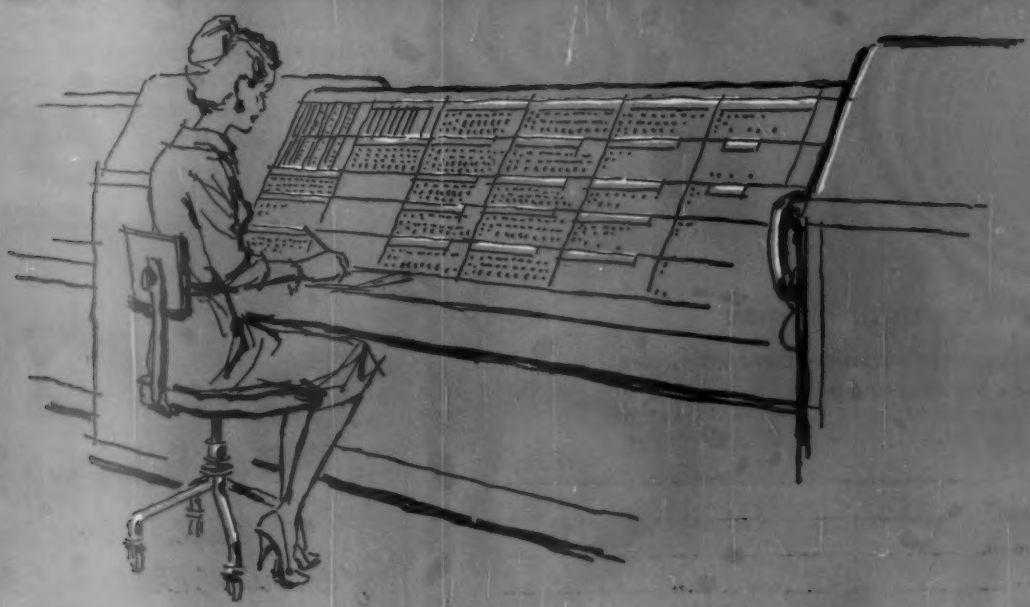

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STUDS THAT BACK OFF FAST

Alloy steel studs made by Republic have accurate, full-formed threads. Exceptional high strength eliminates danger of creep, stretch, or fatigue failure. Usually furnished in AISI 4120 Chrome-Moly Steel, heat treated to ASTM A193, designation B-7, or in designations B-14 and B-15 for higher temperatures. Mail the coupon for free booklet listing types, sizes, and complete specifications.

LIGHT WALL LINE PIPE

You save up to 1/3 the weight—*1/3 the cost*—with Republic Light Wall. Ideal for low pressure gathering and distribution system, this pipe is manufactured to applicable parts of API Specification 5L. Light wall is joined by welding or with light wall fittings. Or, pipe can be grooved for Victaulic Couplings. Republic X-TRU-COAT Plastic-Coated Steel Pipe is available in light wall sizes for greater corrosion-resistance.

PLASTIC PIPE FOR SOUR CRUDE

With more than 15,000 feet in service, the R. S. Anderson Oil Company, Midland, Texas, has been using SRK® Plastic Pipe to handle sour crude for three years. In lines once replaced every six to eight months, SRK is still in service. There is no corrosion, no evidence of chemical action in general, and very little damage from abrasion. Savings—already estimated at 50%—continue to grow. Mail coupon for complete data on Republic SRK.

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- ☐ Casing and Tubing
- ☐ Alloy Studs and Hex Nuts
- ☐ Republic Light Wall
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Address_____

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World's Widest Range of Standard Steels and Steel Products

ratings—from 1,000 to 20,000 psig. and 5,000-ohms resistance value.

The Model H-148 transducer is a potentiometer type that provides a high-level a.c. or d.c. electrical signal which may be used without amplification. Sealed against entry of sand or spray, the transducer uses a helical bourdon-tube pressure-sensing element which is said to eliminate the need for mechanical linkages.

The potentiometer wiper connects directly to the bourdon tube, thus reducing friction and the effect of vibration, the maker points out. Measuring 1 by 1½ in., the transducer weighs only 3½ oz. The maker says it will operate within a temperature range of —65° to 275° F. Source: **Servonic Instruments, Inc., 640 Terminal Way, Costa Mesa, Calif., U.S.A.**

●

New position indicator

. . . detects up to 10 ft. of fluid level or mechanical motion, the maker says. High and low contacts may be incorporated within the probe to operate remote warning lights or other indicators, either visual or audio type.

In the basic unit, a traveler or float rides along a probe. The probe is connected to a direct-reading receiver, mounted either remotely or directly to the probe.

A follower within the probe is magnetically coupled with the moving traveler. It shunts out part of a resistive circuit across which the receiver meter is connected. Source: **Gems Co., Inc., Sheppard Lane, Farmington, Conn., U.S.A.**

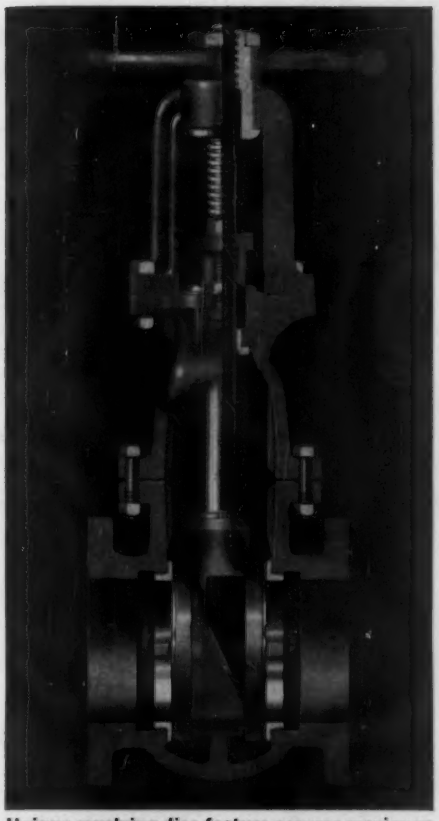
●

Brushless motor

. . . has been developed which, the maker claims, has a life expectancy under many severe operating conditions of 20 to 100 times that of a motor with conventional carbon brushes.

Transistors are used instead of conventional brushes. According to the maker, this change eliminates brush wear and the usual motor

For severe corrosive conditions specify ALUMINUM GATE VALVES by Darling



Unique revolving disc feature assures maximum life under the most exacting service conditions. Friction between wedges is reduced to a minimum. Horizontal and vertical equalization of wedging pressure is assured.

Handling corrosive chemicals such as hydrogen peroxide, ammonium nitrate, acetic acid, concentrated nitric acid? Darling Aluminum Gate Valves give you longer life, cut maintenance costs, under these and other severe service conditions. Here's why:

Darling metallurgical engineers have thoroughly tested and standardized on the most highly corrosion-resistant aluminum alloys in use today.

Accurate casting control and precision assembly reduces friction and wear, provides maximum ease of operation.

Darling Double Disc Parallel Seat principle assures freedom from leakage, trouble and downtime.

Darling aluminum alloy valves are available in sizes from ½" through 24". Write us about your requirements and service conditions.

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Manufactured in Canada by
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for easy, fast loading of tractors and other self-propelled vehicles. Designed for easy maneuverability on construction sites, oil leases and in-city work, this new Leland unit eliminates skid loading. It can easily be pulled by a regular truck with trailer hitches . . . no fifth-wheel is required.

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makes field welding jobs fast, simple. By mounting a gasoline powered welding machine on the famous "Packaged Unit" body Leland has produced a unit that is capable of handling the most difficult jobs in the field. This unit will quickly winch, tow or hoist the heaviest equipment into position for welding.

"Packaged Unit" Body

Fifth Wheel Body

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Fast service from Leland is the answer to your construction equipment problems. Leland provides complete parts and service on Thew-Lorain . . . Gardner-Denver . . . C-M-C . . . Blaw-Knox . . . Cedarapids . . . Cleveland Trenchers . . . Bros Road Equipment . . . Tulsa Winches.

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EQUIPMENT COMPANY
Oklahoma City • TULSA • Longview, Texas

SHOWCASE . . .

New Equipment

interference with radio and radar transmission.

The brushless and transistorized motor is said to avoid the disproportionate friction losses which may occur in small brush type of d.c. motors and to permit a reduction of motor size. Source: **Eastern Air Devices, Inc., P. O. Box 412, Tulsa 1, Okla., U.S.A.**

●

Corrosion

. . . measured fast in the field with a new instrument now on the market, called the Model CK-2 Corrosometer, the maker says. The instrument is suited for laboratory work too. Weighing 11 lb., it comes in an aluminum case measuring 12 by 10 by 5¼ in.

Operation requires three steps: (1) select the probe, (2) set the voltage, and (3) null balance and read. Instrument features include a built-in standard probe for a fast meter check; an integral, reel-stored cable; mercury-battery power; and an integral battery-test circuit. Source: **Crest Instruments, 11808 S. Bloomfield Rd., Santa Fe Springs, Calif., U.S.A.**

●

Pressure-gage protection

. . . is offered by this Model 530 gage protector for gas service. It measures only 1⅞ in long. Providing a maximum set pressure protection point of 1,000 psig., the unit will safely handle inlet pressures up to 3,000 psig. at temperatures from —10° to 200° F., the maker says.

Three range springs are available.

A MATTER OF CONTROL

In the Orient the cormorant industriously catches as many fish as it can. But its masters put a ring around its neck to prevent it eating what it catches. It's a matter of control. Yet you can be sure the master gives the cormorant enough fish to sustain healthy life and growth. Some for the master; some for the cormorant. Otherwise, no fish for anyone!

Under federal regulation we have, within 16 years, brought natural gas by pipeline to distributing systems serving 24 states with a population of 118 million. Given enlightened regulation in the future, we will continue to better and enlarge this public service.

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POWER FLOW in the OIL FIELDS

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BALL BEARING MOTORS

Here's Why . . .

They are specifically designed to overcome the unusual conditions of Oil Field requirements, and there is a type and H.P. built to fit your exact needs. Unexcelled since they are . . .

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- **FORCED AIR COOLED**
- **HAVE SEALED TERMINAL PORT**

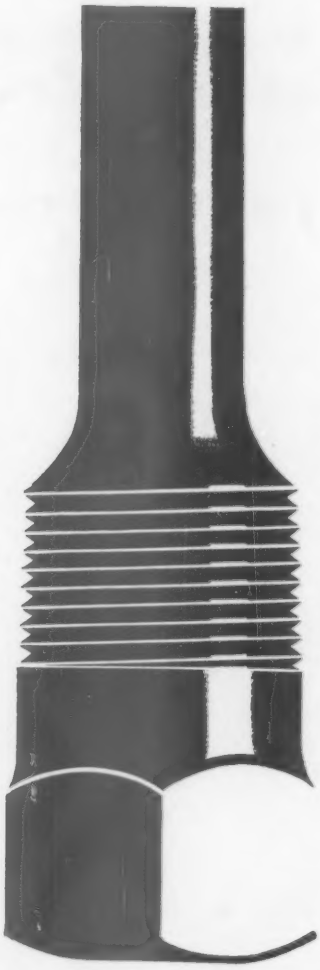
SEMI-ENCLOSED — normal or medium slip, 3 phase, 60 cycle. Has prelubricated ball bearings in semi-enclosed protected housing, 40 degree C rise. Built for continuous duty. High Torque, low starting current. Extra insulating coating throughout.

TOTALLY ENCLOSED — Fan cooled, normal or medium slip, 3 phase, 60 cycle. Has prelubricated ball bearings, totally enclosed FAN cooled 55 degrees C rise, for continuous duty. High Torque — low starting current. Extra insulating coating throughout.

Write for fully descriptive literature

BETHLEHEM STEEL CO. Supply Division **Tulsa, Oklahoma**

Manufactured by Valley Electric Corporation, St. Louis 8, Mo.



THERMOCOUPLE WELLS

Nine basic types of standard pressure-tight wells, with or without T/C assemblies, and any type of special wells made to order. All are beta-gage checked for concentricity. Thermocouple wells are among thousands of accessories—all available from a single dependable source—that can help your instruments perform at their very best.

Get complete details from your nearby Honeywell field engineer, or write today for Catalog G100-5.

MINNEAPOLIS-HONEYWELL, Wayne and Windrim Avenues, Philadelphia 44, Pa. In Canada, Honeywell Controls, Ltd., Toronto 17, Ontario.

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First in Control

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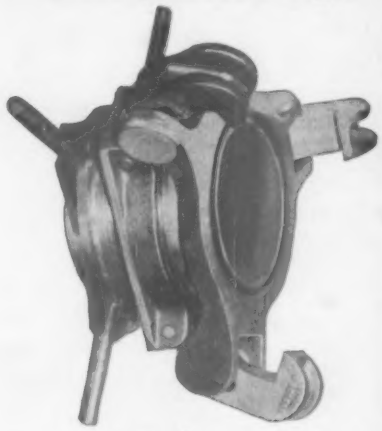
It's Here! The New, All-In-One Coupling To Make Heavy Hose Connecting A Safe, One-Man Operation

QD-16 COUPLING



This new hose coupling eliminates the use of bolts, nuts, and can be easily adjusted to accommodate the variations found in foreign counterparts of American flanges.

Brochure on Construction and Operation of the *QD-16 Coupling* is available. Request on your company letterhead.

Flight Refueling, Inc.

COMMERCIAL PRODUCTS SECTION
BOX 1701 • BALTIMORE 3, MD.

SHOWCASE . . .

New Equipment

These cover pressure ranges from 30-150 to 500-1,000 psig. Inlet and outlet connections are a ½-in. NPT female type. These permit the gage to be threaded directly to the protector.

Without removing the unit from the system, the set protection point can be adjusted. Once set, the protector remains fixed and immediately stops the flow to the gage when pressure reaches the set point. Reset automatically occurs when pressure drops below protection point. Source: **Hoke Inc., 1 Tenakill Park, Cresskill, N. J., U.S.A.**

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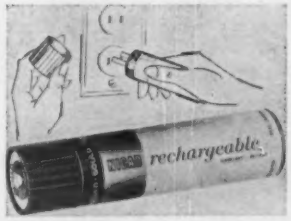

Rechargeable flashlight battery

. . . is on the market which the maker claims provides a minimum of 250 recharging cycles. The Nicad cartridge fits all D-type two-cell flashlights. A removable cap permits recharging in any a.c. 110-volt electric outlet.

Using nickel-cadmium construction, the battery is hermetically sealed. Recharging time to full capacity is about 14 hours. Source: **Gould - National Batteries, Inc., Nicad Div., 172 Pleasant St., Easthampton, Mass., U.S.A.**

●

Compact hand tachometer

. . . makes speed measurement easy. The Series 27 Tripletach instrument comes in three types: Type A for 200 to 10,000 r.p.m., Type B for 100 to 5,000 r.p.m., and Type C for 20 to 1,000 r.p.m.

Three scales, changed by a simple

DayLight Flights

on Delta DC-7's between New Orleans and

CARACAS $173.60
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tourist fares from New Orleans

Choose Deluxe or Tourist Service

Royal Service features complimentary champagne and beverages, fabulous full-course meals, extra stewardesses, fast baggage handling, much more. Meals are complimentary on Tourist Service, beverages available.

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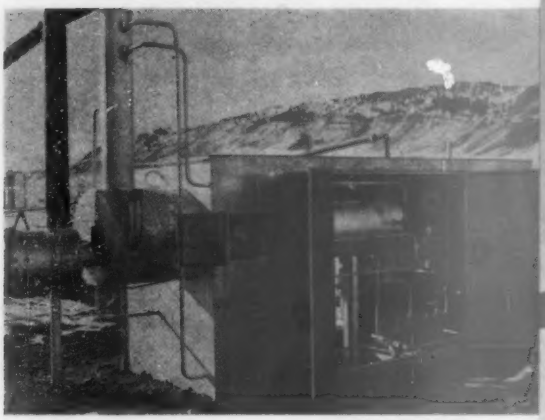
CINCINNATI

This ESKIMO Dehydrator is located in the Big Piney Field, Western Wyoming.

DEHYDRATION

till Hell freezes over



with ESKIMO

The ESKIMO — BS&B's Economy Glycol Dehydrator — is a self-contained unit, housed and protected against extremely low ambient temperatures.

This unit has 3-phase resolution of the well stream and 65° dewpoint depression of effluent gas. It is equipped with flame arrestors for maximum safety against fire hazards.

ESKIMO is available in 2 MMSCFD and 4 MMSCFD units with 2 or 3-phase integral scrubbers, and operates on an unattended basis.

Ask your BS&B man about ESKIMO or write to Black, Sivalls & Bryson, Inc., Dept. 1-A1B, P. O. Box 1714, Oklahoma City, Oklahoma.

BS&B

BLACK, SIVALLS & BRYSON

OKLAHOMA CITY • EDMONTON • LONDON • PARIS • THE HAGUE

thumb switch, permit fine readings within these speed ranges. Accuracy is reported to be ±1% of full scale.

A metal case contains the sealed meter movement, printed circuitry, speed pickup, and retractable cord. It stores the shaft tips and other accessories. Source: **Metron Instrument Co., 432 Lincoln, Denver 3, Colo., U.S.A.**

•

Threaded aluminum-pipe

. . . fittings in sizes from ⅛ to 4 in. are available in a new line. The aluminum fittings are designed for use with aluminum pipe in handling high-purity or corrosive fluids. They can also prove useful as stair and guide railings, piping systems, and for tubular construction in electrical work.

Aluminum threaded fittings are said to be easy to handle and install. Source: **Latrobe Foundry Machine & Supply Co., Box 431, Latrobe, Pa., U.S.A.**

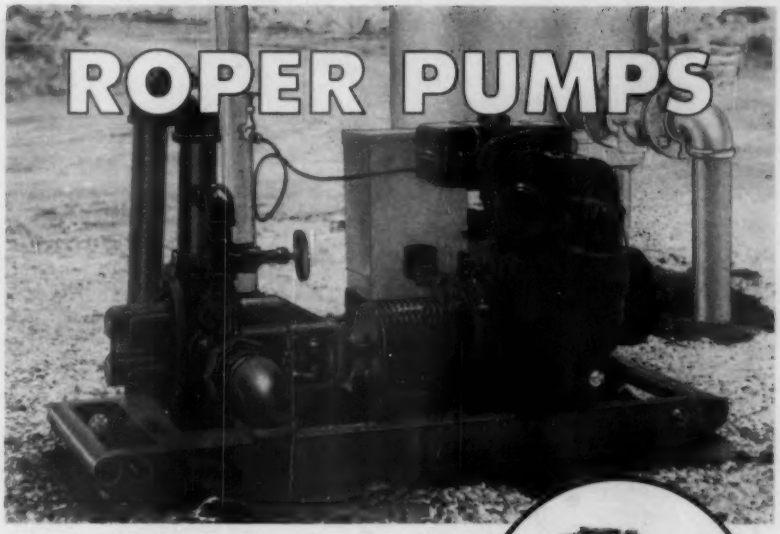
•

Blowout preventer

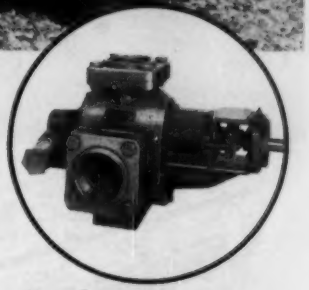
. . . for shallow work during the large-hole, shallow-depth phases of drilling programs was recently developed. It provides low weight combined with high strength and offers a way to reduce transportation and handling as compared with older types, according to the maker. The Model LWS unit has an 11-in. bore and comes in a 10-in., API Series 900 rating.

To achieve low weight combined with high strength, the maker uses a "deep-rib" casting technique. A single-unit Series 900 LWS preventer weighs about 2,100 lb. compared to about 4,000 lb. for older types.

According to the maker, the Series 900 unit can be used in initial programs in an arrangement of two single preventers clamped together to provide the dual protection of a double unit. It can also be obtained in a unitized double-gate design. Source: **Shaffer Tool Works, 209 S. Pomona Ave., Brea, Calif., U.S.A.**



SERIES 3600 No. 2A



keep crude waste low, boost profits by recirculating tank bottoms

OPERATING CAPACITY: 50 BBL/HR @ 50 PSI

With this type circulating unit you need not dispose of tank bottoms on roads or by burning. You can circulate and recirculate tank bottoms to salvage useable crude from residue. This unit (assembled by Harley Sales Co., Tulsa, Okla.) consists of a Roper Series 3600 #2A pump direct connected to a gear box on a Wisconsin engine. Special variable by-pass allows operator to control volume of fluid going through heater treater. • Roper pumps can be equipped with totally enclosed anti-friction bearing reduction assemblies for high-speed operations. Three gear ratios interchangeable in each size are available. Mechanical seals, built-in relief valves, and steam chests are among the optional features you can get on your Roper pumps.

FINELY MACHINED CONSTRUCTION

GEARS: Helical-type, hardened alloy gears run in axial hydraulic balance, vibration-free as a result of perfect meshing.

BEARINGS: High-lead bronze bearings are self-lubricating, supporting the pumping gears on both sides. Sleeve bearings are heavy-duty bronze.

SHAFTS: All shafts, precision ground steel, are induction hardened at bearing and packing surfaces.

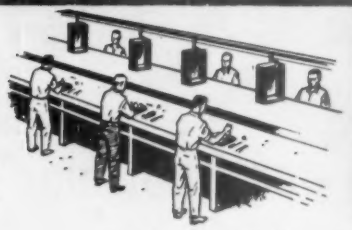
For information about your specific pump needs, contact your nearest Roper dealer

Send for "How to Solve Pumping Problems" booklet

ROPER HYDRAULICS, INC.

Dependable pumps since 1857

COMMERCE, GEORGIA



Get the economies of factory assembly

. . . plus satisfaction of field personnel by using Nelson Switchracks

Centralized motor control is the modern trend. In the above photo you see a Nelson switchrack with various components including control switches to motors driving the processing pumps in a fractionating plant of Warren Petroleum Corporation.

For outdoor installations Nelson switchracks provide ease of installation and all the advantages of factory assembly and wiring. One purchase order, one receiving report, yet you receive a complete unit. At Nelson each switchrack is specially designed to give the customer the ultimate in performance.

Nelson switchracks are available in either single front or double front, and with or without canopies for weather protection. Components can either be explosion-proof (NEMA 7), watertight and dust-tight (NEMA 4 & 5) or oil immersed (NEMA 8). If you have no preference for arrangement Nelson engineers will design to give you maximum utility in minimum space.

For more complete information write for Bulletin 497

At Nelson . . . *quality* comes first!

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TULSA, OKLAHOMA

P. O. BOX 5385 NATIONAL 7-5530

SHOWCASE . . .

New Literature

Subsurface-recorders

. . . catalog features pressure and temperature instruments for wire line or go-devil surveys. Included in the literature are gage clocks, micrometer chart readers, fishing tools, supplies, and replacement parts. Source: **V. E. Kuster Co., 537 Bixby Road, Long Beach 7, Calif., U.S.A.**

Single-shaft gas turbine

. . . Model 305-S (9,000 hp.) for mechanical and generator drive, is outlined in Bulletin 186 just released. The literature contains a discussion of applications for the unit, including compressor, pump, and generator drive, as well as process integration. Dimensions and specifications are included. Source: **Clark Bros. Co., Box 560, Olean, N.Y., U.S.A.**

Parallel-shaft speed reducers

. . . Booklet 2719 describes "balanced design" parallel-shaft reducers in 57 sizes. Along with data for selecting the correct drive for various applications, the 36-page publication contains 16 rating tables which offer thermal and mechanical horsepower ratings for each input and output speed. Load classes are shown for some 250 driven machines. Other tables give overhung loads, extended shafts and outboard bearings, dimensions, and ratios. Source: **Link-Belt Co., Prudential Plaza, Chicago 1, Ill., U.S.A.**

Half a Man is Not Enough

. . . is the title of a new 12-page booklet which discusses the problem of overspecialization by engineers with its resultant lack of development in the fields of human interests and understanding. It points out that human interests must balance technical efficiency before an engineering specialist can really be on the road to success and happiness. The booklet also contains a 14-point check list which may be used as the basis to develop a formula for well-rounded, successful living. Source: **Heat Exchanger Div., Western Supply Co., Box 1888, Tulsa, Okla., U.S.A.**

Drop-forged steel flanges

. . . catalog contains specifications for 150 to 1,500-lb. drop-forged steel and welding-neck flanges. Charts relate dimensions for pipe size, hub diameter, size, and number of bolts. Included is data on typical flange facings and drilling templates. Source: **Harrisburg Steel Co., 1003 Herr St., Harrisburg, Pa., U.S.A.**

Protective coatings

. . . brochure presents solutions to a variety of corrosion and deterioration problems by using Bitumastic cold-applied protective coatings. In addition to covering the properties and specification data on nine Bitumastic products, eight-page Bulletin T-97-61 lists typical installations requiring corrosion protection along with the recommended coating. The coatings, which are applied cold by brush, spray, and roller, are designed to meet specific problems—underground corrosion, water exposure, corrosive atmospheres, chemical and mechanical destruction of steel, etc. Source: **Tar Products Div., Koppers Co., Inc., Koppers Bldg., Pittsburgh 19, Pa., U.S.A.**

Digital speed-measurement

. . . systems Bulletin 2000 illustrates instrumentation designed to provide an accurate and trouble-free method for measuring, indicating, or recording most rotative motion. One section describes the proper selection and operation of magnetic and photoelectric pickups, electronic tachometers, and "in-line" readouts built for applications where temperature, moisture, and vibration problems exist. The six-page literature offers easy-to-read specification tables and recommendations for the application, mounting, and coupling of different models. Source: **Meriam Instrument Co., 10920 Madison Ave., Cleveland 2, Ohio, U.S.A.**

Catalysts catalog

. . . details catalysts for gas processes, petroleum, and chemical industries. Properties and uses are given for catalysts, including new steam-hydrocarbon reforming, hydrogenation, selective hydrogenation, and nitrogen-oxides-removal catalysts. Activated montmorillonite catalysts, also described, are said to

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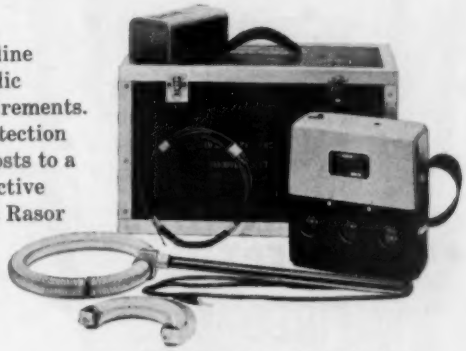
TINKER & RASOR HOLIDAY DETECTORS

insure coating continuity

Every void in your pipeline coating increases cathodic protection current requirements. To obtain maximum protection and hold maintenance costs to a minimum, inspect protective coating with a Tinker & Rasor Holiday Detector and make repairs before backfilling.



Tinker & Rasor E P Holiday Detector.
Portable, "damp-climate" pulse type.

Write for your free Data Kit.

Tinker & Rasor has prepared a complete data kit of descriptive material and recommended procedures for inspecting protective coatings. Material includes technical data on equipment, recommended inspection procedures, general discussion of types of detectors, theory of operation, etc.

ENGINEERING NOTE:
To insure a perfect application, include Tinker & Rasor Holiday Inspection. Write for specification guide.

Quality Control for Coating Application

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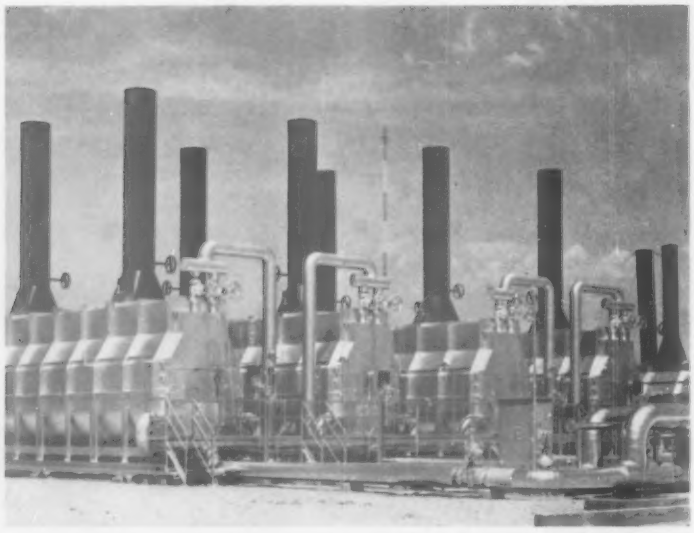
417 Agostino Road, P.O. Box 281 • San Gabriel, California



100,000 to 200,000,000 BTU

PETROCHEM VERTICAL AND HORIZONTAL DIRECT FIRED HEATERS

For the petroleum, chemical and petrochemical industries, Yuba now offers the most complete series of direct-fired heaters available. From 100,000 to 200,000,000 BTU per hour—from -200° to +2,000° F—Petrochem Vertical and Horizontal Heaters can be built in every size and type for every use in any location!

Yuba Heaters are available from the most simple horizontal design to the famous Petrochem vertical with optional reradiation cones for even heat distribution and maximum efficiency.

Working closely with both customer and prime contractor, Yuba can provide single piece, shop-assembled horizontal heaters *to 30,000,000 BTU*. Other heaters up to 50,000,000 BTU can be provided in two sections. For field installations of larger heaters, Yuba can provide well-trained supervisory personnel when desired. Get the complete story on Petrochem direct-fired heaters from Yuba – your largest single, fully-integrated source of supply.

Other Yuba Products For The Petroleum, Chemical and Petrochemical Industries—Adsco Expansion Joints, Transaire Air-Cooled Heat Exchangers, Shell and Tube Heat Exchangers, Southwest Floating Roof Tanks, Cone Roof Tanks, Pressure Vessels, Field Erection, Columns and Towers, Process Condensers, Custom Fabrication.

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specialists in process heaters—every size, capacity and duty

YUBA TULSA CORPORATION
Tulsa, Oklahoma

YUBA CONSOLIDATED INDUSTRIES, INC.

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offer highly selective activity in reactions otherwise catalysed with hydrogen acids. The final group of catalysts outlined are those available for customer use in research and process investigation. Source: **Girdler Catalysts, Chemical Products Div., Chemetron Corp., Box 337, Louisville 1, Ky., U.S.A.**

Heat-exchanger bulletin

. . . details fixed tube plate, U-type, and floating-head heat exchangers in a 14-page form. Floating-head models described include lantern-ring, split backing ring, and pull-through types. Other chapters deal with mechanical design, thermal design, installation, operation, maintenance, and cost factors. The publication includes photographs, cutaway drawings, charts, and construction and application data. Source: **Whessoe Ltd., County Durham, Darlington, England.**

Free catalyst calculator

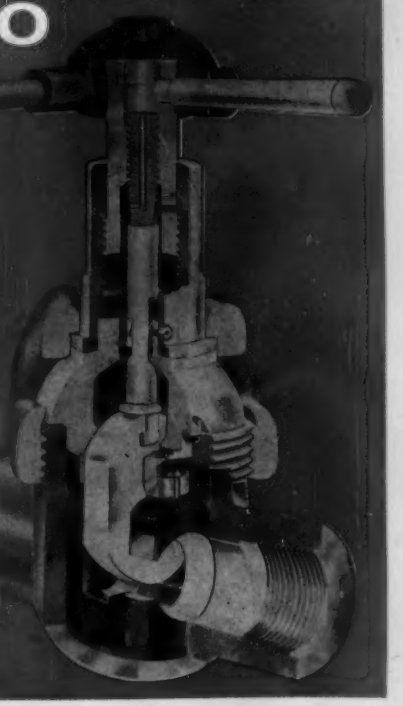
. . . called the "Davison Catulator," a 6½ by 12-in. plastic-coated slide chart, is being offered as a technical aid for engineers concerned with fluid catalytic cracking. It can be used to calculate: (1) catalyst carbon-burning rate and hydrogen on coke directly from a flue-gas Orsat analysis; (2) catalyst-bed densities and levels directly from manometer readings; and (3) catalyst-vessel inventories and addition rates directly from level changes. Source: **Davison Chemical Div., W. R. Grace & Co., Dept. T, Baltimore 3, Md., U.S.A.**

Science of fluid processes

. . . called "Fluidics," is explained in Bulletin 992 as a program providing a modern, imaginative approach, plus specialized materials and equipment, for profitable handling and processing of liquids and gases. The 16-page guide deals with such products as monel, titanium, Glasteel, equipment for reactions, distillation and evaporation, drying and blending, centrifuging, heat transfer, filling, storage, agitation, valving, piping, equipment for water treatment, ion exchange, gas analysis, flow-rate metering and control, and waste treatment. Source: **Pfaudler Div., Pfaudler Permutit Inc., 1121 West Ave., Rochester, N. Y., U.S.A.**

The DEMCO

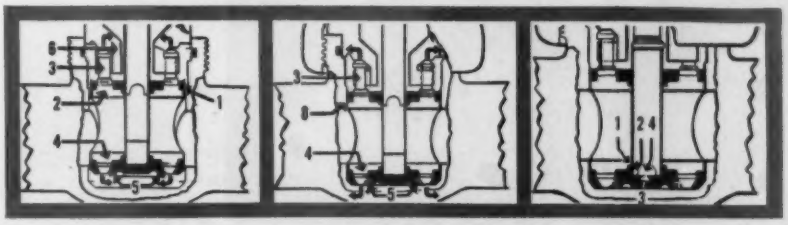
GATE VALVE



Seals DROP-TIGHT without "bumping"

Positive sealing under the highest line pressures—*with minimum torque*—makes the Demco GATE VALVE your best buy for every mud line application . . . for water flooding, hydra-frac, acidizing and cementing service . . . and for many production applications.

Demco's secret lies in its unique one-unit seal assembly, with its patented spread-ring construction. Here's how it works . . .



A. Resilient seat assembly (1) is reinforced with steel wear rings (2), having integral projecting pins at top (3) and bottom (4). In normal contracted position, the seat assembly is easily inserted in, removed from the body. Until the seat assembly is bottomed, the steel spread ring (5) does not act upon the lower projecting pins, nor do the bonnet legs (6) act upon the upper pins.

B. With the bonnet down and the seat assembly bottomed, the spread ring (5) has forced the lower projecting pins (4) outward. Similarly, the upper pins (3) have been wedged outward by the descending bonnet legs, providing a tight seal between body wall (8) and seat, preventing entrance of abrasives between seat and body wall.

C. As gate is closed, leading edge of gate slides past wear ring (1), contacts rubber ring (2) for positive rubber-to-metal seal. Seal occurs before gate touches rubber cushion (3), eliminating need for "bumping." Relief in bottom of gate (4) allows straddling of solid particles that might interfere with proper closure.

Available at supply stores everywhere in 1,000, 1,500, 2,000, 3,000 and 5,000 psi working pressures . . . in two-, three- and four-inch sizes.

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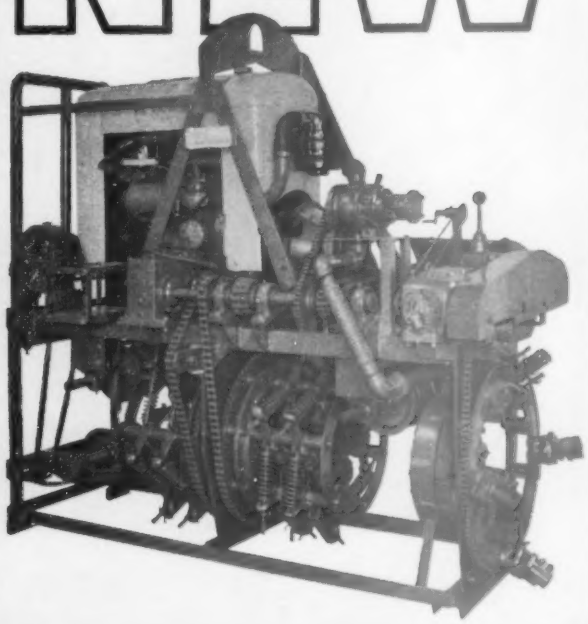

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The New Crose Combination Cleaning and Tape Wrapping Machine has variable speed tape wrapping head; built-on blower to remove dust from pipe prior to applying tape, and baffles incorporated into machine's design to protect wrapping area from dust. Four models — comparable to the Crose Cleaning and Priming Machine — handle these pipe sizes: 2″-4″; 4″-16″; 16″-32″ and 34″-40″.

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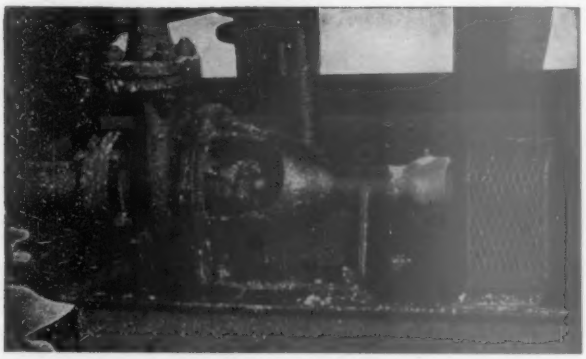

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▶▶▶ Equipment Men Notes

George E. Failing Co. combines

John McMahan

... its Gulf Coast district offices with headquarters in Houston, and its southeastern district offices with headquarters in Hattiesburg, Miss., under single management. The Enid company, a subsidiary of Westinghouse Air Brake Co., manufactures portable rotary rigs.

John McMahan, former manager of the Hattiesburg store, will supervise both units, according to E. A. Johndrow, vice president of sales. McMahan started with Failing in 1949 as a member of the Enid sales staff. He became manager at Hattiesburg in 1953.

General Electric Co. lays plans

... for the establishment of a new advanced computer development and research laboratory at Sunnyvale, Calif., 39 miles south of San Francisco, according to Clair C. Lasher, general manager of GE's computer department. Construction of the 49,000-sq. ft. lab is expected to start this spring with occupancy scheduled for December.

The laboratory building will be expandable to 76,000-sq. ft. if required. Estimated cost is about $1,500,000. Laboratory work is now being done by a staff of 85 in rented facilities at Palo Alto, Calif.

Schlumberger makes 11 shifts

... in its field organization in the Mid-Continent and Texas divisions. Involved are: F. G. Williams, field engineer-special services at Liberal, Kans., named sales engineer; J. V. Crues, senior sales engineer in the Permian Basin division, moved to McCamey, Tex., as location manager; R. S. Beaty, former location manager at McCamey, transferred to Tyler in the same capacity; C. F. Grice, previously Tyler location manager, moved to the Houston headquarters as operations engineer; D. M. Quillin, Permian Basin division engineer, transferred to the Mid-Continent area as assistant to the area manager; E. S. Scholl, engineer in the Oklahoma division, shifted to the Mid-Continent area; and H. D. Babcock, division engineer, moved to the Permian Basin division from Kansas.

Other changes in field personnel assignments include: E. D. Percifield, sales engineer at Mount Pleasant, transferred to Lansing, Mich.; C. R. Ferguson, shifted from the south Rocky Mountain division to Kimball, Neb., as a sales engineer; C. W. Buchholz, Pacific Coast division engineer, transferred to Long Beach as location manager; G. D. Volkel, former location manager at Long Beach, moved to the Pacific Coast area as division engineer; and W. J. Hickman, operations engineer at the Houston headquarters, transferred to the Louisiana Gulf Coast division and promoted to division engineer.

Oakite Products, Inc. appoints

... Ken C. Tucker to assistant sales manager of the firm, which manufacturers specialized chemical compounds for industrial cleaning and metal treating. Formerly manager of Oakite's food-industries division, Tucker has been with the firm since 1945.

One of his major responsibilities will be the servicing of national accounts. He will report to William A. Baltzell, vice president and sales manager.

Robert C. Dunlap, Jr. is elected

... a vice president of Texas Instruments, Inc., and Fred J. Agnich has resigned his corporate officer post with the company, according to President P. E. Haggerty. Agnich will continue as a member of the TI board of directors. Dunlap will become operating head of the company's geosciences activities and will continue to serve as president of Geophysical Service Inc., TI's wholly owned exploration subsidiary.

G. D. Duke is service manager

... for Johnston Testers, Inc., reports B. R. Dixon, vice president of operations in the firm's Houston headquarters. The appointee will supervise all Johnston Testers service in 45 operating districts throughout the U. S.

Duke began with the firm as a tester in 1946. He was in charge of Kansas-Oklahoma operations before transferring to Houston in 1958 as assistant manager of operations. He was promoted to southern division manager in 1959.

Jack E. Cooper is elected v.p.

... of Diamond Chain Co., Inc., Indianapolis-based subsidiary of American Steel Foundries, Chicago. He joined Diamond Chain in 1951 and had been manager of sales since October 1959. Cooper will be in charge of all company sales operations.

Jimmy Abercrombie becomes

... a service representative in the Mississippi-Alabama area of Technical Oil Tool Corp., according to E. G. McConnell, vice president. Abercrombie will work under the supervision of Howard Reid, Totco area manager.

E. Frank Sanford, Jr. is named

... Texas Gulf Coast area representative for Kilby Steel Co., of Anniston, Ala., according to George M. Tope, sales manager. Sanford has been in oil-industry tubular sales the past 5 years, working out of Houston for a supply company.

Kilby Steel, a 71-year-old firm, recently set up general sales offices in Houston in preparation for entering the oil and petrochemical industries with the sale of seamless tubing.

Thomas J. Faver joins

... Tyson Smith Co. as sales manager of the firm's oil and gas division. Making headquarters in Houston, he will coordinate sales and service of oil and gas process equipment throughout Texas, Louisiana, and Oklahoma.

Faver has held sales posts with Gamlen Chemical Co., Magnus Chemical Co., and Spar Chemical Co., serving as vice president and national sales manager of the latter firm. Most recently he was with Mott Co., of Houston, manufacturers of gas-processing equipment.

Burton Joseph is sales manager

B. M. Joseph

... of the Industrial & Oil Field Division of Young Radiator Co., with plants in Racine, Wis. and Mattoon, Ill. The appointment was announced by F. M. Young, president.

Joseph formerly was employed by Griscom-Russell Co., Massillon, Ohio, as a sales engineer, and by Yuba Industries, Inc., San Francisco, as district sales manager. Immediately prior to his appointment at Young Radiator, he was general sales manager of Solar Chicago, a division of U. S. Industries, Inc.

Arnold R. McLain is appointed

... general manager of Yuba Heat Transfer Division, Honesdale, Pa., annnounces John L. McGara, president of Yuba Consolidated Industries, Inc. McLain goes to Yuba from Com-

bustion Engineering, Inc., manufacturers of steam-generating and fuel-burning equipment, where he held the post of general manager of one of the firm's manufacturing divisions. He served 25 years with Combustion Engineering in engineering and manufacturing executive assignments.

Hill Hubbell expands sales force

. . . by elevating Jack A. Harrison from district sales manager, southeastern U.S., to general sales manager. He joined the company in 1954 and was general purchasing agent before entering the sales echelon.

Howard Trusler, a veteran of 12 years in the protection-coating industry, has joined Hill-Hubbell as district sales manager with a territory of Ohio, West Virginia, Kentucky, and parts of Pennsylvania. He was formerly Houston regional sales manager for Pittsburgh Coke & Chemical Co.

M. M. Bowen, Jr. has been appointed district sales manager, covering the states of North and South Dakota, Nebraska, Kansas, Iowa, Missouri, and Minnesota. An employe of Hill Hubbell since 1956, he will be based at Omaha. Bowen was formerly with National Screw & Mfg. Co.

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THESE EXCLUSIVE C·R·C FEATURES MEAN MORE FOOTAGE PER DAY: Faster Hook-Up • Easier Handling • Balance Selector Lifting Eyes • "Unitized" Design For Rugged Dependability—Minimum Maintenance.

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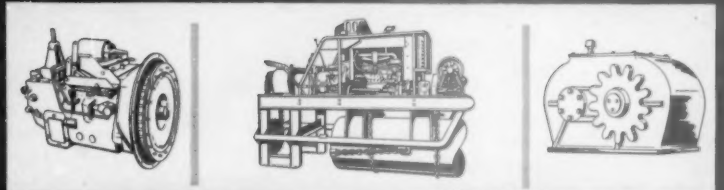

Funk Revers-O-Matic Drive gives a smooth, shock-free drive, eliminates stalling and lugging.

Pipe saddles are an integral part of "Unitized" frame, adapted to casing with liners, eliminating costly extra parts. Adjustable pull-hooks eliminate need for welding on pusher lugs.

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W. C. Norris appoints two

. . . in the sales department of its Tulsa general office. Homer Hill, former office sales coordinator, has become manager of wellhead sales. He will serve as consultant and wellhead specialist and will work with the company's division sales managers and sales representatives throughout oil-producing areas. Taking Hill's place as sales coordinator is Orville L. Scott. His job will be to coordinate field and office sales activities.

Johnston Testers, Inc. sets up

. . . a coring service and two new Rocky Mountain district service locations, according to G. D. Duke, service manager. Johnston's coring in the Rocky Mountains is done under franchise from Hycalog of Shreveport.

New locations are at Gillette, Wyo., and Wolf Point, Mont., and bring to 10 Johnston's locations serving the Rocky Mountain area. Operations in the area are under the direction of M. A. Carter, in Casper, Wyo.

Jones & Laughlin Supply makes

. . . two changes in its field force, announces W. L. Wolfe, vice president in charge of sales. C. R. Jones, salesman in the Tulsa city sales office, is now assigned in the same capacity at Amarillo, and J. H. Thompson, storeman at Houston, has been promoted to salesman and assigned to Beaumont.

Jones was first employed by J&L as salesman at Midland in 1949. He was transferred to Bartlesville in 1953, and later in that same year moved to Tulsa. Thompson joined the division as storeman at Houston in 1960.

John D. Craddock is manager

. . . of Continental-Emsco Co.'s Longview, Tex. branch store. He was formerly a district production machinery specialist in Tyler, Tex. Craddock began his employment in 1948 as a floorman, and has also served as a field salesman, production-equipment salesman, and sales representative.

Other C-E changes involve: Earl D. Stanley, pump-shop foreman in Pratt, Kans., named D+B specialist there; and Don L. Etter, field salesman in Wichita Falls, Tex., promoted to D+B specialist in the same location.

Also promoted to D+B specialists are John B. McLeroy and Charles B. Tobler. McLeroy, former field salesman, will be stationed in Sundown, Tex., and Tobler, previously a sales-engineer trainee, will be in Abilene, Tex. Continental's new division oil-country-tubular representative in Los Angeles is Clifford C. Dunseth.

?

WHY CONTROLLED SOLUBILITY PHOSPHATES

Glassy phosphates have been successfully used to prevent scale in oilfield brines since the late 1930's. However, continuous treatment was difficult to achieve since the only phosphates available dissolved quite rapidly. Now months of continuous and effective treatment can be obtained from a single charge with Controlled Solubility Phosphates because solution rates have been chemically slowed down.

The controlled solution rate or "self-feeding" property explains the rapid acceptance of Controlled Solubility Phosphates by the oil producing industry. Here are the answers to the most asked questions about this unique development in scale prevention:

? How do the Phosphates work?

A By stabilizing a condition of supersaturation. The glassy phosphates are adsorbed on the nuclei from which crystal growth would normally proceed. The result is inactivation of the nuclei, interrupting precipitate formation. This is known as "Threshold Treatment" due to the very small amount of phosphate required.

? Can Controlled Solubility Phosphates be added directly to producing wells?

A Yes. The simplest and most popular method is dropping a measured quantity down the annulus of producing wells. The individual particles of phosphate, resembling crushed glass in appearance, are carefully sized to fall freely through condensate zones, oil layers and heavy brines. Once down in the well bore the "self-feeding" action takes over. This makes possible the continuous addition of a few parts per million of phosphate to the water.

? Is there a chemical test which can be used with Controlled Solubility Phosphate treatment?

A Yes. Produced water or brine should be checked for its phosphate content on a scheduled basis. Field Test Kit #K0080 has been specifically designed for this purpose.

? Where can I purchase Controlled Solubility Phosphates?

A At leading oilfield supply stores throughout the United States and Canada.

A complete discussion of oilfield brines in relation to scale formation and the use of Controlled Solubility Phosphates for the prevention of scale is yours for the asking. Write:

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Data on active fields:

Lisbon, Utah

1. Approved field name: Lisbon. Location, Northeastern San Juan County, Utah, 22 miles north of Monticello, Utah, in Paradox basin.

2. Discovery well: Pure 1 Northwest Lisbon, NE NW 10-30s-24e. Completed January 4, 1960. Initial potential: flowed 857 bbl. oil per day through 14/64-in. choke from Devonian at 8,261-8,348 ft.

3. Trend of development: Northwest-southeast in both directions from discovery well.

4. Number of producing wells: Eight, two additional (California Co. and Pure C-2) being completed.

5. Spacing pattern: Tentative, not yet established.

6. Proved acreage: Structure is approximately 4 by 3 miles, 7,000 acres approximately.

7. Principal operators are: Pure, Pubco, Belco, Elliot, Standard of California.

8. Present allowable: 150 bbl. of oil per day. Flare maximum of 300 M.c.f.d. of gas.

Drilling Operations

9. Number of active drilling rigs: Only Calvert active, drilling for California Co.

10. Casing program: Varies. 13⅜-in. surface, 9⅝-in. intermediate at top of salt (optional), 5½-in. through Mississippian-Devonian.

11. Average drilling time per well: 75-120 days.

12. Types of drilling fluid: Chemical mud to top of salt, salt base with oil through salt and Mississippian-Devonian. No-block mud occasionally used through Mississippian-Devonian.

13. Completion methods: perforate casing, acidizing, and fracture treatment.

14. Types and sizes of bits: 8¾-in. tricone rock bits.

15. Special drilling problems: Crooked-hole trouble.

Geology

16. Producing formations and depths: Paradox salt, oil and gas, 5,844-6,132 ft. Mississippian, oil and gas, lime, 8,129-8,830 ft. Devonian-McCracken sand, oil and gas, 8,254-9,226 ft.

17. Reservoir characteristics: Water and gas-solution drive. Gas-oil ratio: Mississippian, 2,400:1. Oil-water contact, −2,570± ft. Gas-water contact, −2,150± ft.

18. Geologic markers: Due to structural relief depths not indicated, Hermosa, Paradox, salt, Molas, Mississippian, Ouray.

19. Type trap: Anticline (below salt formation).

20. Core data: Porosity, 3-20% (5% average). Permeabiblity, 0-250 md. (25 md. average). Total water saturation, 40-45%. Cored interval, 8,506-8,610 ft. Net feet of pay, 135.

21. Estimated recovery: 4,500 bbl. per acre average; 4 M.M.c.f.d. per acre average (these figures conjectural).

22. Pressures: Devonian, flowing tubing, 250 psi. Mississippian, flowing tubing, 660 psi.

23. Tests and logging procedures: DST's and cores through producing interval, ES induction log above salt, Sonic-Gamma ray, Laterolog, and neutron log.

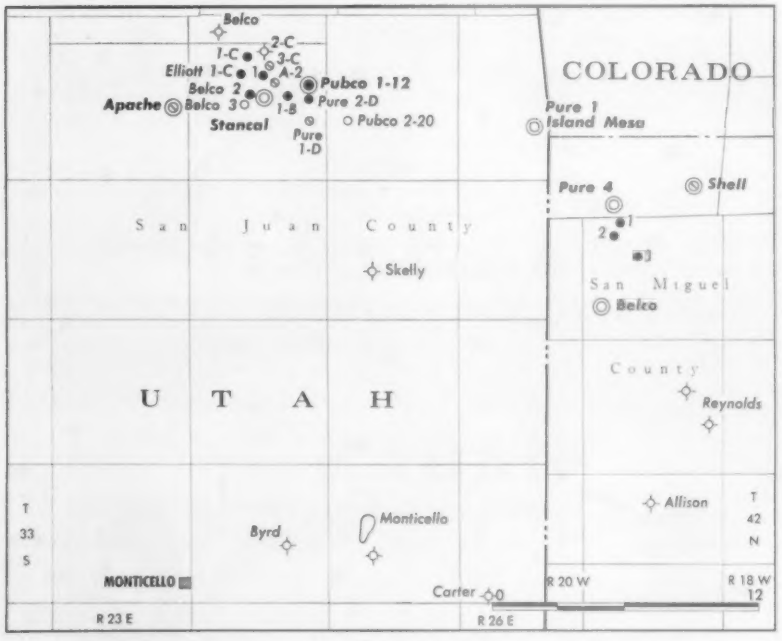
24. Pipeline outlet: Pacific Northwest Pipe Line Co. (Possible gas outlet.)

25. Exploration methods prior to discovery: Seismic and surface geology.

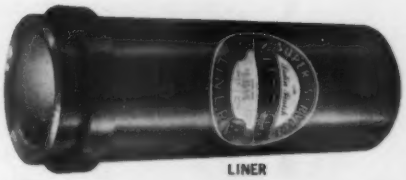
26. Average costs: dry hole, $200,000. Flowing well, $325,000. Pumping well, $350,000. Average total depth, 9,000 ft. Footage rate, $10. Day rate, $1,150 (with pipe). Average lease price, $24 to $100 per acre recently; $15 before discovery well.

27. Crude analysis: Gravity, °API, Mississippian, 54°-55°; Devonian, 44°-45°.

Pure Oil Co. is purchaser for all oil in field. (Currently being trucked.)



STAGE of development at Utah's Lisbon mirrors high interest.

The Mission  Mission

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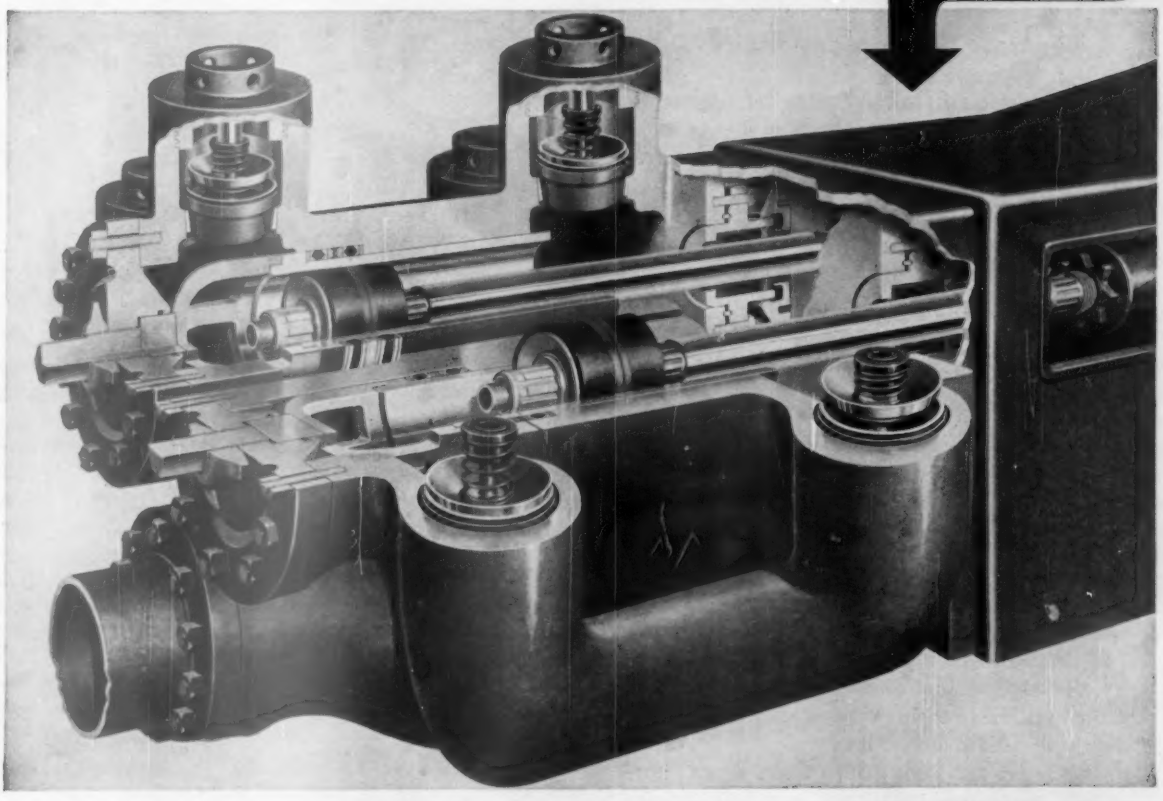

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The economical addition of SOLTEX to drilling fluids has saved many wells which were scheduled to be abandoned because of formation sloughing, pipe sticking, and lost circulation encountered in highly compacted and horizontally stressed shale sections.

In many test wells drilled under more "normal" conditions, SOLTEX modified drilling muds have produced remarkable savings . . . ranging as high as $23,000 from reduced drilling time, less bit wear, etc. Mud engineers associated with SOLTEX field applications agree . . . "It's one of the most important mud discoveries since DRISCOSE, the original CMC material." When used with DRISCOSE , it further increases the range, speed and over-all economy of your drilling operations.

For more complete information on SOLTEX —contact your mud dealer or see your Drilling Specialties Company representative.

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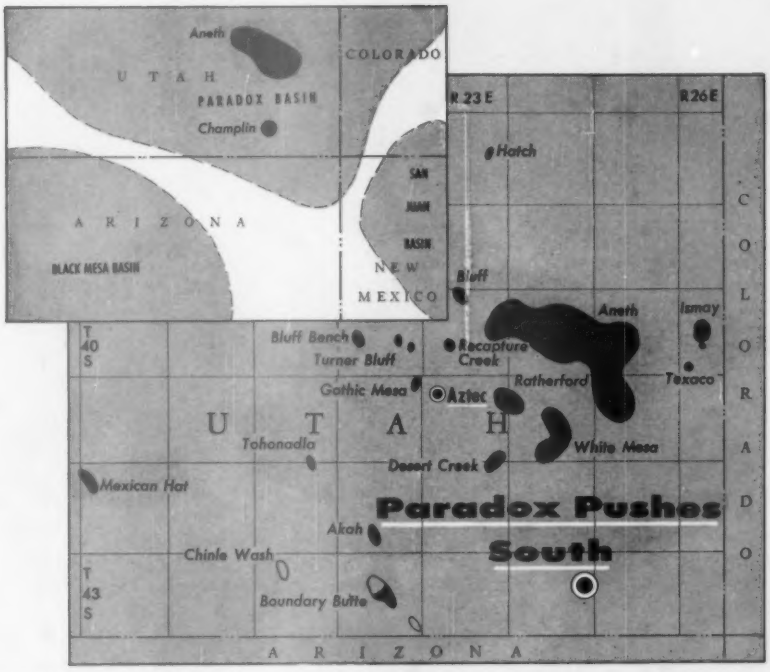


THE 2,085-BBL. DISCOVERY at Anido Creek field, southeastern Utah, is expected to kindle a new exploratory interest in the Four Corners region during 1961. Two offsets have already been staked east and west of the discovery.

Anido may stir Paradox basin anew in 1961

BY FRANK J. GARDNER

THE NEW YEAR opened on a hopeful note. Four important new discoveries pelted the map from Alberta to Louisiana during the first 2 weeks of January (OGJ, Jan. 16, 1961, p. 52).

Let's hope this is an omen of better times. For certainly, 1960 was an exploratory lemon. With the possible exception of Utah's Libson field, and Montana's Tule Creek, explorationists can point to not one major discovery last year. And even those two have yet to prove themselves.

Of the discovery quartet mentioned above, one is truly significant. This is Champlin Oil & Refining Co. and Murphy Corp. 1 Navajo-111, Section 13-43s-24e, in San Juan County, Utah. It pushes the Paradox basin play straight toward the Arizona line and broadens the front for future Pennsylvanian exploration in Colorado, New Mexico, and Arizona.

A flush discovery . . . This 2,085-bbl. discovery, now named Anido Creek, produces from the Ismay-Pennsylvanian section at 5,304-26 and 5,338-46 ft. It was carried to total depth 6,610 ft. in Mississippian, another possible pay target in this basin. Unlike the Aneth fields to the north, where the Ismay is the stingy section and the underlying Desert Creek-Pennsylvanian the prolific one, the Anido Creek discovery found the Ismay a better friend; the Desert Creek yielded only fair shows of oil. The Mississippian proved a poor show.

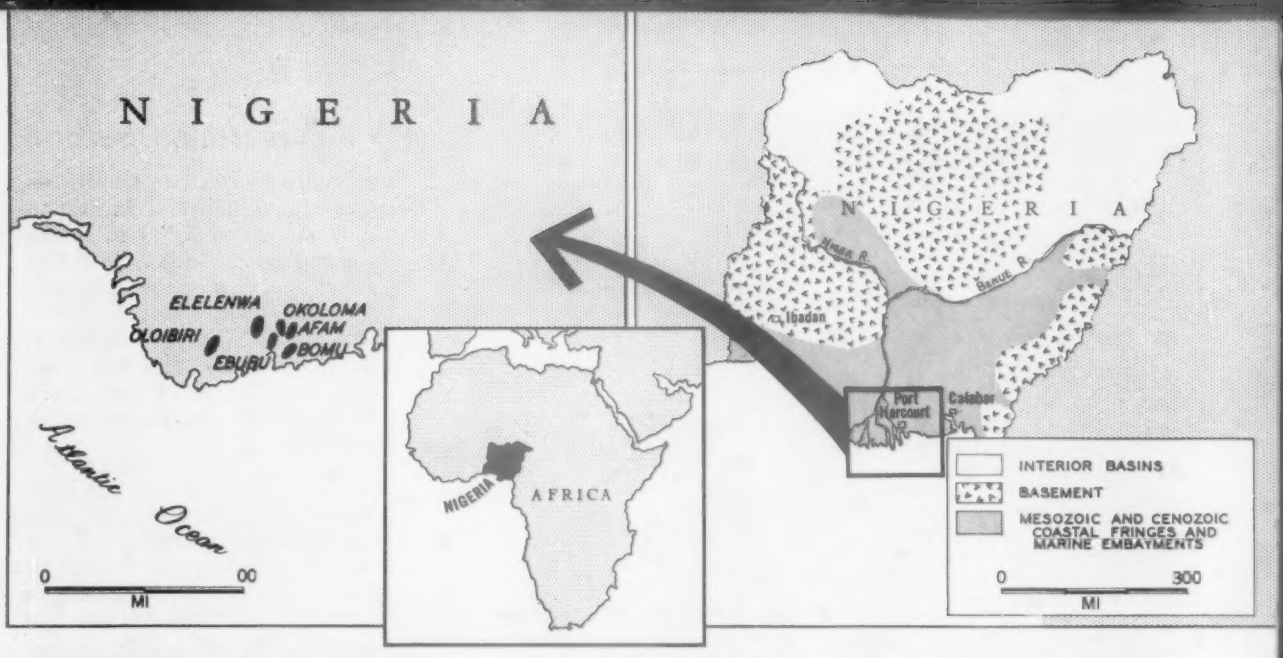
Champlin now has located a direct southwest offset to the discovery at the Navajo-111, in Section 13; it will go to 5,600 ft. in the Paradox section. Sinclair Oil & Gas Co. has also entered the field, with a southeast offset in Section 18-43s-25e; this one, Sinclair 1 Navajo-5, will go to the Barker Creek zone, which underlies the Desert Creek and Akah zones of the Hermosa-Pennsylvanian.

Gets set for rules . . . Champlin and Murphy hold a block of 1,280 acres in the immediate vicinity of the new discovery, and they have applied for 80-acre spacing rules in Sections 11-14, 23, and 24 in 43s-24e, and in Sections 7, 18, and 19 in 43s-25e. The Utah Oil and Gas Conservation Commission will hold a hearing on the field on March 7.

Perhaps this interesting new Paradox discovery will stir the imagination of Rocky Mountain oil finders anew. For the past 2 years, the Aneth region has lapsed into some kind of exploratory coma, as all eyes were trained on Lisbon to the north. Only one discovery was made in the southern Paradox basin in all 1960, and it was a sick cat . . . the Texaco Inc. 1 Navajo "U" NCT, Section 32-40s-26e, posted a potential of only 14 bbl. of oil and 17 bbl. of water on pump last August. It was an Ismay producer at 5,420-60 ft.

One other recent discovery, originally finished in 1960, but now recompleted for flush 1961 production, is Aztec Oil & Gas Co. et al. 58-1 Navajo, in Section 7-41s-23e (see map). Originally, it was drilled to total depth of 5,725 ft. by Zoller & Danneberg; Aztec assumed operation at that point. Most recent potential at the well reads 145 bbl. per day on 10/64-in. choke; production is from Desert Creek perforations at 5,592-5,700 ft. The first completion here was effected in late December for 98 bbl. per day. Not yet named, this discovery lies 1½ miles southeast of Gothic Mesa field.

The outlook for the Paradox basin is decidedly brighter for 1961. Look for a surge of wildcats this year, aimed at Pennsylvanian, Mississippian, and Devonian targets . . . not just in the southeastern basin lobe, but throughout the Paradox country.



AFRICA'S NEWEST NATION, Nigeria, ranks fourth among current continental oil producers. This production comes from six fields in the southern coastal embayment. Nigeria is about equally divided geologically. The country is about one-third basement rock, interior basins, and coastal fringe or embayment areas.

Newest nation has big oil potential

BY JOHN C. McCASLIN
District Editor

AFRICA'S NEWEST NATION, Nigeria, is the fourth-largest oil producer on the Dark Continent.

With current daily output of 15,500 bbl. and a 1959 oil flow of 4,096,000 bbl., Nigeria is fourth-ranked in Africa after Egypt, Algerian Sahara, and Gabon. Its gain in oil status hasn't been as fast nor as prolific as the Sahara or the not-yet-producing Libyan fields, but its production should cut a respectable niche in Africa's oil column in the coming years.

Nigeria's birth. Nigeria joined the world family of nations just last October 1. About 38 million people live in an area as big as Texas and New Mexico combined. This compares with Congo's 14 million and Ghana's 5 million. The French African nations together have only 27 million people. Thus Nigeria will be a political and economic power in Africa.

The people. The northern part of the country houses mostly nomadic Moslem tribesmen. Southern and western areas contain about 6½ million Christians and 13 million Moslems. The nation's economic wealth to date has been concentrated on the heavily forested plateau county north of the coast where mahogany, rubber, cocoa, tin, palm oil, and coal are heavy export items. Now oil is flowing into world markets from this new oil nation.

The land. Geographically, Nigeria is quite varied. Northern reaches of the country are similar to parts of the Sahara. The land becomes increasingly forested and jungle-covered to the south and west. The Niger River flows 2,600 miles from its headquarters in Sierra Leone through French Guinea and French Sudan, thence through Nigeria to the Atlantic. This stream and its partner, the Benue River, form a perfect Y near the center of Nigeria, dividing the country into three almost-equal parts.

The geology. Nigeria is about evenly divided between areas of basement rock, interior basins, and coastal fringes and marine embayments.

(Text continues on page 140)

AERIAL VIEW shows water transport unloading point, offices, and No. 2 location at Oloibiri, the first oil field in Nigeria found by Shell-BP. (Photo courtesy Shell Oil Co.)

Nigerian facts and figures

Total production, 1959	4,096,000 bbl.
Cumulative production, Jan. 1, 1960	5,984,334 bbl.
Daily output, Nov. 1960	15,500 bbl.
Active rigs, Nov. 1960	5

WELL COMPLETIONS, 1959

	Total	Oil	Gas	Dry	Success ratio
Wildcats	37	9	3	25	32.4
Field wells	16	16	0	0	100.0

1959 WILDCATS THAT HAD SHOWS, COMMERCIAL AND NONCOMMERCIAL

1. Shell-BP Ikono. TD 11,050 ft. Little gas, temporarily abandoned.
2. Shell-BP Imo River. TD 9,651 ft. Tested oil.
3. Shell-BP Korokoro. TD 10,500 ft. Tested oil.
4. Shell-BP Bodo. TD 10,001 ft. Tested gas, temporarily abandoned.
5. Shell-BP Benin West. TD 8,691 ft. Traces of oil, abandoned.
6. Shell-BP Ika. TD 12,012 ft. Suspended, tested gas.
7. Shell-BP Okoloma. TD 10,040 ft. Tested oil. Discovery.
8. Shell-BP Ughelli. TD 12,022 ft. Tested oil, suspended. Indicated discovery.
9. Shell-BP Elelenwa. TD 11,000 ft. Tested oil, discovery.
10. Shell-BP Aba Town. TD 8,008 ft. Tested gas, suspended.
11. Shell-BP Igrita. TD 10,700 ft. Tested oil.
12. Shell-BP Alakiri. TD 11,490 ft. Tested oil.
13. Shell-BP Ibibio. TD 9,179 ft. Tested oil.

FOOTAGE (TOTAL)

Afam	19,050 ft.
Bomu	84,680 ft.
Ebubu	27,408 ft.
Wildcats	406,249 ft.
Total	537,387 ft.

FIELD WELLS

Afam	2 producers completed
Bomu	11 producers completed
Ebubu	3 producers completed

FIELD AND SEISMIC EXPLORATION

Surface geology . . . Mobil Exploration Nigeria, Inc., had 8 party-months
Seismic . . . . . Shell-BP had 72 party-months, Mobil 13
Structure . . . . . Mobil had 0.75 party month

INDIVIDUAL FIELD DATA

Field	Company	Disc.	Total wells	Pay	1959 prod. (bbl.)	Cum. prod. (bbl.)
Oloibiri	Shell-BP	1956	16	Miocene	1,798,803	2,815,330
Afam	Shell-BP	1956	13	Miocene	1,104,187	1,755,964
Bomu	Shell-BP	1958	13	Miocene	370,226	525,220
Ebubu	Shell-BP	1958	4	Miocene	758,634	759,024

Figures from AAPG July 1960 Bulletin and The Oil and Gas Journal.

Most of the oil fields in the country lie near the Niger Delta in the marine embayments and coastal fringe areas. The northeastern and northwestern corners of the country are parts of the Chad and Niger interior basins, respectively. Cretaceous - Tertiary sediments in the coastal embayments make up some of Africa's most attractive oil-hunting grounds. These embayments and coastal fringes are not limited to just Nigeria, but are common to Spanish Sahara, Mauritania, Senegal, Gabon, Gabinda, Angola, South West Africa, Swaziland, Tanganyika, Somalia, Ethiopia, Sudan, and on the Mediterranean Coast east of Tunisia.

Nigeria is almost new in oil circles. Shell-BP has tapped at least six commercial oil fields in its exploratory program in past years. This campaign cost about $175,000,000.

Bomu is the biggest producing field with more than 8,000 bbl. per day. Other fields are Oloibiri, Afam, Ebubu, Okoloma, and Elelenwa. Last year Shell-BP found oil at its Ughelli wildcat in the western part of the country. This was the first oil found west of the Niger River, 70 miles northwest of nearest production at Oloibiri. That strike came after 5 years of unsuccessful wildcatting in this part of Nigeria. Ughelli is considered to be an oil discovery, but is not on production. It opened a vast new area of hope for oil in the western part of Nigeria. Shell-BP has found oil in at least a dozen wildcats in 20 years of Nigerian exploration. Most of them were one-well producers, however. Many were never fully determined as to their worth.

New activity. Tennessee Overseas Co., through its subsidiary, Tennessee Nigeria, Inc., has begun exploring its 1.2 million acres on the Atlantic Coast 25 miles east of Lagos, Nigeria's capital city. Earlier this year, Tennessee Gas Transmission Co. formed the subsidiary to receive an exploration license from the Nigerian Government on the concession. Adjoining concessions already have production.

Production rise. Nigerian crude production may reach 200,000 bbl. per day during the next 10 years, putting the nation in the ranks of important oil countries of the world.

By the end of 1961 the oil output should rise to 50,000 bbl. per day, 90,000 bbl. per day in 5 years, according to estimates. A pipeline to a new tanker terminal on the coast, running 10 of its 18 miles along the bed of the Bonny River, will carry an expected 30,000 bbl. per day from the nation's six fields soon. The 12-in. line is laid from a temporary terminal at Port Harcourt to facilities at Bonny. This will be an extension to the small system already transporting oil from Shell-BP fields to Port Harcourt. Tankers up to 18,000 tons will pick up crude at the new West African port.

Last year's search. During 1959 Shell-BP more than doubled Nigeria's oil output to 4,096,000 bbl. This oil came from Oloibiri, Afam, Bomu, and Ebubu fields. Bomu and Ebubu were both opened in 1958. There were 37 wildcats drilled last year for a new drilling record. All were Shell-BP wells. Of this 37, 9 were indicated oil discoveries, 3 tested gas. The company had six seismic crews in the field during the year, and at year's end were operating seven rigs on wildcat locations. Currently, there are five rigs running in the country.

Mobil Exploration Nigeria, Ltd., spudded its first Nigerian wildcat late in 1959. This well was located near Afowo on Mobil's concession in the western sector of the country. Mobil kept a seismic outfit busy on this concession during the year.

Mobil is now testing up the hole in its second wildcat in Nigeria, spudded October 26 about 8 miles west of Lagos. Hole was bottomed at 6,000 ft. Three tests on the lower portion of the hole gave no indication of oil or gas.

Before drilling this well, Mobil carried out extensive seismic work throughout the concession area in the eastern portion of the Guinea embayment.

Key to the future. With the whole oil world giving a good hard look at Africa's tremendous oil potential, Nigeria will see an intensified exploratory and development era. As the continent's rise to oildom continues at its rapid clip, Nigeria's contribution to world oil chests will strengthen and expand accordingly.

Two U. S. firms are looking for high-priced offshore acreage off the coast of Nigeria. Newcomers are Gulf Oil Corp. and American Overseas, a California-Texas affiliate. The companies have entered applications for tracts on which the Nigerian Government has $1,400,000 premiums asked. Each firm filed for two 1,000-sq.-mile areas on the continental shelf. These applications are still pending.

Australian tectonic map is available

The tectonic map of Australia, which is now available for sale to the public, is the first of its kind to be produced for Australia.

The map is for use in the search for oil, in prospecting for minerals, and in basic geological studies. Its compilation is the result of several years' work by several organizations and a number of individual geologists throughout Australia.

The project originated with the Australian and New Zealand Association for the Advancement of Science some years ago, and was later taken over by the tectonic-map committee of the Geological Society of Australia.

The committee which compiled the map included representatives of the society, state geological surveys, universities, and the Bureau of Mineral Resources, Geology, and Geophysics. It was assisted by geologists from mining and oil-exploration companies, and by the Royal Australian Navy. The base map and ocean contours were prepared by the Division of National Mapping, and the tectonic map was drawn and published by the Bureau of Mineral Resources.

The map reveals the major rock structures directly attributable to earth movements involved in folding and faulting through the ages. In addition it portrays the latest information on the regional geology of Australia.

This map will be of interest to geologists, geophysicists, and geographers. It provides a broad picture which shows major structures and trends, folds, and faults. It depicts, also, the subsurface shape of the sedimentary basins and the area and extent of the older mineralized sequences: It summarizes and generalizes the latest stratigraphic

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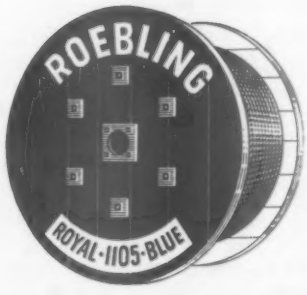

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Kaneb picks up new Pennsylvanian discovery

Redwillow County, Nebraska, has another Lansing-Kansas City Pennsylvanian oil pool. Discovery well is Murfin Drilling Co. and Lewis & Jones 1 Gallatin in C NW NW 32-3n-26w.

Operators are reportedly testing on pump, but no official gages have been released. Before installing pump, swab got 30 bbl. per hour from perforations at 3,324-28 ft. Some reports credit the well with pump gages of 100-150 bbl. daily.

Location is 1¼ east of Sleep Hollow field, separated from production by a dry hole. Name of Bartley has been given the field.

West Texas field gains second Wolfcamp producer

The second Wolfcamp production in Emperor field area, Winkler County, far West Texas, is Humble Oil & Refining Co. 2 Brown & Altman Gas Unit "A", 6 miles east of the town of Wink.

The well had a calculated absolute open-flow potential of 5 M.M.c.f.d. from perforations at 7,255-98 ft. From Fusselman perforations at 9,386 to 9,471 ft. the well flowed 10,250 M.c.f.d.

Texas' Ward County bags Pennsylvanian discovery

A new Pennsylvanian field was opened in northeastern Ward County, 4½ miles southwest of Monahans in West Texas. The discovery well is Gulf Oil Corp. 515 Hutchings Stock Association.

The well flowed 204 bbl. of 37.2°-gravity oil per day on potential test through 8/64-in. choke from perforations at 8,088-8,132 ft. Location is in Section 74, Block N, G&MMB&A Survey, 1¼ miles east of North Ward field and 3 miles south of a 7,012-ft. dry hole.

Strawn discovery. Pembrook & Liedtke 1 Hataway, northwestern Scurry County, 7 miles south of Fluvanna, Tex., was completed flowing 184 bbl. of 40°-gravity oil per day through 18/64-in. choke from perforations in the Strawn Pennsylvanian at 7,704-08 ft. Location is in Section 327, Block 97, H&TC Survey, 4 miles west of Arah-Ellenburger field.

Ward County. A strat test drilled by Gulf Oil Corp. in northern Ward County, 3 miles south of Monahans, was completed as a Mississippian gas discovery. Gulf 505 Hutchins Stock Association, flowed 14,300 M.c.f.d. and 41 bbl. condensate from perforations at 7,388-7,408 ft. Location is in Section 53, Block N, G&MMB&A Survey, 3½ miles east of North Ward field.

Kingfisher activity still commands Sooner interest

Oklahoma's Kingfisher County, busiest area in the nation last year, continues its rapid drilling pace in 1961.

Humble Oil & Refining Co. completed 1 Matousek in C NE NW 34-19n-7w, Southwest Hennessey field, flowing 15 bbl. of 41.4°-gravity oil per day through ¼-in choke from Mississippian at 7,112-7,330 ft. From Manning, the well flowed 268 bbl. in 11 hours through 21/64-in. choke from perforations at 6,866-6,909 ft.

Oklahoma Natural Gas Co. gaged 34 bbl. of oil per hour on a 6-hour test of Mississippi lime at 2 Patocka in C SW SE 14-19n-6w, from open hole at 6,686 to 6,812 ft. Jones & Pellow Oil Co. completed 1 Patocka in C SW NW 9-19n-6w flowing 508 bbl. of oil in 19 hours through 20/64-in. choke from Manning at 6,599-6,639 ft., making 439 bbl. in 14 hours through 22/64-in. choke from Meramec open hole at 6,844-75 ft.

Pan American Petroleum Corp. dually completed 1 Vincent in C NE NW 26-18n-7w, North Dover field, flowing 200 bbl. per day from Oswego perforations at 6,588-93 ft. From Manning at 7,022 to 7,034 ft. the well flowed 186 bbl. in 7 hours through ¾-in. choke. Daily rate was 638 bbl.

Ellis County. In northwestern Oklahoma, Pan American tested 1 Irvin in Chaney field to flow 2,534 M.c.f.d. from Morrow perforations at 8,130-34 ft. This is the second producer for the new field in 31-24n-24w. The discovery well was 1 State-J in C NE SW 36-24n-24w.

New field opened near OU's South Campus

A new Bromide sand Ordovician oil pool was tapped just south of Norman and north of South Norman field, Cleveland County, Central Oklahoma.

Anderson-Prichard Oil Corp. 1 Navy, NE SW SW 5-8n-2w, on the South Campus of Oklahoma University and on the old South Naval Base, flowed oil during tests at 8,016-32 ft. Location is 1¼ miles north of multipay South Norman field and 1½ miles northwest of Northwest Noble pool, a 5-zone Ordovician field.

Harper County. Sinclair Oil & Gas Co. is taking production tests at 1 Yauk in C NE SW 22-28n-21w, Harper County, northwestern Oklahoma.

The well flowed 1,635 M.c.f.d. from Morrow Pennsylvanian perforations at 5,737-42 ft. More zone is being perforated at 5,718-33 ft. A test at 5,718-51 ft. got 7,876 M.c.f.d. and some condensate.

Triple well. Hall-Jones Oil Co. triply completed 1 Gritz in C NE NE 22-19n-6w, East Hennessey field, Kingfisher County.

The well flowed 120 bbl. per day through ¼-in. choke from Oswego perforations at 6,200-14 ft.; 155 bbl. per day from Meramec, and 144 bbl. per day from Manning through ¼-in. chokes.

Caddo County. Mobil Oil Co. is testing in the upper zone of the Cherokee at 1 Weathers, a southwestern Oklahoma wildcat in C NE SW 8-12n-11w, near Bridgeport.

The well flowed up to 3 M.M.c.f.d. from perforations in the lower Cherokee Pennsylvanian at 11,338-11,476 ft. Through 12/64-in. choke, the well flowed 19 bbl. condensate in 13 hours and 800 M.c.f.d. Perforations at 11,278-11,307 ft. have been treated. Testing continues.

December footage breakdown

	FIELD WELLS					WILDCAT WELLS			
	Oil	Cond.	Gas	Dry	Service	Oil	Cond.	Gas	Dry
Alabama	26,405								34,884
Alaska	32,796		5,125						8,634
Arizona				1,180					19,941
Arkansas	94,826		16,625	88,642		4,205			35,284
California	385,027		28,793	43,092	9,800	7,315		27,363	136,589
Colorado	49,779	11,500	98,938	95,984		16,562	9,170	23,106	183,297
Florida									14,000
Georgia									4,551
Illinois	206,698			87,982	132,036	8,369		998	78,627
Indiana	51,347			49,405	3,290			1,122	18,244
Kansas	494,195		49,744	257,897	52,070	31,615		25,066	358,913
Kentucky	137,771		5,865	88,366		1,667		3,117	6,689
Louisiana	1,477,296	276,970	154,252	674,200	2,671	27,142	58,033	980	263,584
North	182,972		62,701	107,817		14,627		980	108,705
South	1,056,342	239,730	86,859	503,602	2,671	12,515	43,106		127,878
Offshore	237,982	37,240	4,692	62,781			14,927		27,001
Michigan	54,624		4,464	33,709					67,327
Mississippi	240,159	31,159	27,299	152,971		36,179			226,950
Montana	92,595			12,207				4,064	93,168
Nebraska	129,929			138,058		9,868			180,242
New Mexico	421,498		249,309	112,042		14,852			44,830
West	111,443		249,309	11,647					13,692
East	310,055			100,395		14,852			31,138
New York	10,840		7,910	3,933	7,997			1,962	10,059
North Dakota	68,210			14,416					50,411
Ohio	138,683		118,810	45,532	17,319			15,197	23,753
Oklahoma	785,239	7,660	225,670	366,603	148,853	104,023	20,775	43,809	161,658
Oregon									5,879
Pennsylvania	19,488		49,617	26,671	20,860				9,926
South Dakota									901
Tennessee									3,157
Texas	2,806,197	449,551	342,986	1,216,297	102,961	84,298	54,306	20,682	1,062,709
District 1	127,073	10,502		73,802	3,752				70,138
District 2	91,672	56,924	79,503	185,499					102,605
District 3	175,807	121,649	9,334	191,100			10,310		144,619
District 4	185,402	47,647	58,741	140,783	2,432		9,020	4,525	176,216
East	289,710	74,995	21,014	81,182		14,102	11,612		82,299
District 7-B	287,961	7,475	33,267	144,847	13,445	20,660	14,310	16,157	183,452
West	1,231,532	78,176	59,978	173,878	27,400	30,530	3,433		208,705
District 9	268,881	24,675	11,285	143,986	52,592	9,776	5,621		75,900
District 10	148,159	27,508	69,864	81,220	3,340	9,230			18,775
Utah	55,775		12,167	14,440		5,725		4,729	73,383
Washington									4,137
West Virginia	21,267		169,826	26,708	2,120				13,087
Wyoming	238,370		29,317	60,024		17,183			255,618
Total U. S.	**8,039,014**	**776,840**	**1,596,717**	**3,610,359**	**499,977**	**369,003**	**142,284**	**172,195**	**3,420,063**

December footage, Canada 1960

	Field			Wildcats		
	Oil	Gas	Dry	Oil	Gas	Dry
Western Canada	702,044	90,184	106,826	28,301	72,241	222,503
Alberta	482,901	85,849	72,926	19,543	74,908	133,578
Saskatchewan	178,115		33,900	8,758		32,889
Manitoba	10,202					
British Columbia	30,827	4,335				
Northwest Territories					17,333	38,633
						17,403

Canada December 1960 completions

	Total					1960	Wildcats					1960
	Total	Oil	Gas	Dry	Footage	Total	Total	Oil	Gas	Dry	Footage	Total
Western Canada	229	135	31	63	1,222,099	2,436	60	5	14	41	323,045	634
Alberta	137	74	27	36	849,705	1,631	37	3	11	23	208,029	418
Saskatchewan	66	50	0	16	253,661	577	10	2	0	8	41,647	118
Manitoba	5	4	0	1	10,202	68	0	0	0	0	0	11
British Columbia	17	4	4	6	91,128	141	9	0	3	6	55,966	68
Northwest Territories	4	0	0	4	17,403	19	4	0	0	4	17,403	19
Ontario	0	0	0	0	0	306						

Geologists issue slide manual

"Better slides for better meetings" is the objective of the new "Slide Manual" published by AAPG, Tulsa, according to William R. Moran, Union Oil Co. of California, Los Angeles, chairman of the AAPG projection slide committee which prepared the manual.

The 28-page, three-color "Guide to the Preparation and Use of Projection Slides" features eight charts and tables as the key to legible and attractive slides for visual projection at large or small meetings. Illustrations of good and poor slides and slide copy offer authors of technical papers practical tips on how to make effective slides in color or black and white.

Priced at $1.25, postpaid, with discount on orders for 26 or more copies, the manual is available from AAPG, Box 979, Tulsa 1.

Powder River basin nets new Newcastle find

A discovery well was completed east of Skull Creek field in Wyoming's Weston County. Oil City Supply Co. 1 Wyoming Farm & Livestock, NE NW 32-45n-61w, pumped 2½ bbl. of oil per day from perforations in the shallow Newcastle sand at 478-499 ft.

Location is 2 miles east of Skull Creek field, just south of Newcastle, Wyo. Operator is now testing at 2 Del Cris in SE NW 31-46n-61w, ½ mile west of the discovery. Gage was 2½ bbl. per hour from perforations in the Newcastle at 435-452 ft. The 1 Fee in NE SW 31-50n-66w, a third well in the area, has been spudded.

Canadians follow up Cardium success in Alberta's Caroline district

THE TEAM of Hudson's Bay Oil & Gas Co., Ltd., Supertest Petroleum Corp., and Altana Exploration Co., has indicated success at the first followup to its Cardium oil discovery in the Caroline district of Central West Alberta. The indicated success found the Cardium "B", or producing sand, at a favorable elevation and through core and log interpretation pay thickness was enough to warrant the setting of production casing. That latter operation is currently under way.

It will be recalled that the team found the Cardium sand productive at the Supertest-Altana-H. B. 10-26-36-6 Caroline venture, on LSD 10, 26-36-6w5. That venture flowed oil to surface during a drill-stem test of the horizon at an estimated rate of 20 bbl. per hour. The new indicated success, meanwhile, is ½ mile due west of the original strike and 8 miles northwest of Cardium oil success in Garrington pool.

The Cardium zone on the follow-up test, H. B. Supertest-Altana 12-26-36-6 Caroline, on LST 12, 26-36-6w5, was contacted at 7,045 ft., or 3,504 ft. subsea, the Cardium Sand at 7,131 ft., or 3,590 ft. subsea, and the 'B' Sand at 7,265 ft., or 3,724 ft. subsea.

Supertest and Altana, by supplying full costs of the original discovery, earned a ½ interest in seven and ½ sections of petroleum and natural-gas lease rights which were acquired under farmout agreement from Hudson's Bay Oil and Gas Co., Ltd. In addition, the team also holds rights to Drilling Reservation No. 715 in the area. The latter tract contains rights to a total of 9,400 acres, out of which, for drilling the commitment well, 14 quarter sections of petroleum and natural-gas leases may be selected. Meanwhile, interest in the wells, the rights earned from H. B., and in the drilling reservation, is shared: 50% by Hudson's Bay and 25% each by Supertest and Altana.

1960 Canada depth classifications—

	OIL									GAS								
	A	B	C	D	E	F	G	H	I	A	B	C	D	E	F	G	H	I
Total		123	152	665	188	251	8			5	30	41	25	30	36	9	3	
Alberta		5	29	425	185	231	8			5	25	40	20	22	36	9	3	
Saskatchewan		65	123	215	3						5							
Manitoba		53																
British Columbia				25		20						1	5	8				

*Alberta service: 2 D, 40 E.

1960 wildcats

	OIL									GAS								
	A	B	C	D	E	F	G	H	I	A	B	C	D	E	F	G	H	I
Total		4	13	14	25	15	1				12	23	15	39	12	8	2	
Alberta			7	2	24	9	1				10	20	11	28	11	8	2	
Saskatchewan		3	5	11	1						2	2		1				
Manitoba		1	1															
Northwest Territories				1		6						1	3	10	1			
British Columbia													1					

British Columbia adds new gas area

ANOTHER gas area in northeastern British Columbia might well be developed. Triad Oil Co., Ltd., and BP Canada Exploration, Ltd., both subsidiaries of the British Petroleum Co., London, currently drilling an exploratory test in the Wargen-Pickell Creek area of that province, found gas in the Bluesky. The undrilled area between it and another strike in the same horizon 10 miles northwest could prove to be quite interesting. The new discovery Triad-BP c-88-I, Pickell Creek, on quarter unit c, Unit 88, Block I, National Topographic Index Map 94-H-3, found the Bluesky at the 3,525 ft. level and was tested of a 33-ft. interval below 3,535 ft. Gas surfaced in 3 minutes and flowed at a stabilized rate of 4,600 M.c.f.d. for half an hour. The water line, however, was also penetrated somewhere in the interval as 210 ft. of salt water was recovered from the drill-stem upon completion of the test evaluation.

The previous test in the district which found gas in the same horizon, Imperial's b-56-C Wargen is also still an unknown factor. Two stepout wells to it, one 2 miles southwest and the other 2 miles north both proved unsuccessful while the discovery itself has flowed up to 10 M.M.c.f.d. during production tests. Since those two follow-ups were drilled it has been suggested that the formation did follow the southeast-northwest trend and if the newest strike is followed by a well northwest of it and southeast of the Imperial discovery well, that prognosis might be borne out.

The acreage on which the Triad strike was drilled was acquired under farmout agreement from General American Oils, Ltd. That farmout contained petroleum and natural-gas rights in Permit No. 167, a tract of 190,198 acres.

Fields

DRY

A	B	C	D	E	F	G	H	I
1	20	46	60	37	26	4	..	..
1	8	44	24	27	20	4	..	..
..	9	..	35	4	..	..	..	..
..	3	1	..	..	..	..	..	..
..	..	1	1	6	6	..	..	..

DRY

A	B	C	D	E	F	G	H	I
3	35	126	100	96	69	13	8	1
..	8	80	58	84	39	8	8	..
..	16	27	35	12	3	..	..	..
..	5	3	..	1	..	..	..	..
..	..	2	6	7	25	5	..	1
3	6	4	1	2	2	..	..	..

December Multiple Completions

	Dual	Triple
Arkansas	5	..
California	1	..
Colorado	4	..
Kansas	4	..
Louisiana	48	7
South	37	..
Offshore	11	7
Mississippi	1	3
Montana	1	..
New Mexico	19	..
West	10	..
East	9	..
Oklahoma	29	10
Texas	82	3
District 1	8	..
District 2	2	..
District 3	18	1
District 4	14	2
East	9	..
District 7-B	3	..
West	19	..
District 9	4	..
District 10	5	..
Utah	2	..
Total December	**196**	**23**

Michigan slows drilling pace

Southern Michigan has slipped back to its slowest pace in 2 years and needs an important discovery or extension if it is to regain momentum. There were only 15 field drilling operations at the start of the week, widely scattered along the 35-mile trend.

Interest currently centers on cautious efforts to link the Pulaski and Albion pools, divided by a 2-mile undrilled gap; and the Hanover area, 7 miles east of Pulaski, where a 1959-drilled wildcat went on oil after being produced for gas. Three rigs are running in the Hanover area. If one or all of these tests produced it would give the whole southern Michigan district a needed lift. Last August as high as 54 rigs were running in this very same area.

• First 1961 discovery prospect is focusing added attention on St. Clair County. Hartman and McClure 1 Douglass, NW SE NE 15-4n-16e, China Township, gaged 490 M.c.f. gas at 2,196 ft., in the top of the Niagaran reef. Drilling was suspended to change from cable to rotary to enable coring of the section. Test is about 6 miles east of the Peters reef.

Arkansas' Smackover adds good well

Development of deeper horizons in southern Arkansas' old Smackover field has come up with another good well, this one in the Lower Cretaceous-Travis Peak sand.

The new well, drilled by H. T. Pannell, flowed at the rate of 40 bbl. of oil daily through 1-in. choke while testing this lower pay at 3,401-14 ft. Through this choke, pressure was 180 psi., but later on ⅛-in. choke it increased to 725 psi.

A dual completion will be made in this sand, and in a lower Cotton Valley (Jurassic) sand at 3,972-80 ft. A deeper Cotton Valley sand at 4,574-84 ft. also logged good oil showings. Hole was drilled to 4,758 ft. but has oil string only to 4,020 ft.

In the Cotton Valley sand, the well will extend production nearly a mile northeast. Location is on

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PRODUCTS FOR THE OIL INDUSTRY

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the operator's J. Berry Estate lease in 8-16s-15w. Drilling already is under way on another deeper-pay well nearly a mile west, where the location is about ½ mile north of Cotton Valley production.

California gas play starts off big

THE GAS PLAY in California's Sacramento Valley is off to a healthy start in 1961.

Two significant wells have turned up already this year. One has a continuous pay sand of 345 ft. and one of the highest gas flows in the valley. Another has found the deepest gas pay to date in the valley.

McCulloch Oil Corp., Los Angeles, has completed its 1 Duarte in Los Medanos field in the thick pay section. The well's Domengine sand section runs from 3,890-4,235 ft. The well, in 17-2n-1w, Contra Costa County, was drilled to a total depth of 4,321 ft.

Production tests conducted by Pacific Gas & Electric Co. show the well has an absolute open-flow potential of 170 M.M.c.f.d.

The well flowed at the rate of 29 M.M.c.f.d. through a 1-in. choke during one test. The pressure drawdown was only 7%. Flow through a ¾-in. choke was at the rate of 20,000 M.c.f.d.

The Duarte is 3,200 ft. southeast of the 1 McCulloch-Ginochio, which produces from the Domengine at 1,800 ft. The Duarte well is about a mile southeast of a third well which produces from the same formation at 4,200 ft.

Deep production. Artnell Co.'s 1 RUSA-Lederer unit in Sec. 2-10n-1w in Yolo County has the valley's deepest gas production. The well flowed at the rate of 1,050 M.c.f.d. through a ¼-in. choke.

The company is planning to complete the well in two zones at 8,674-80 ft. and 8,715-25 ft., several hundred feet deeper than any previous gas production in the valley. The well went to a total depth of 9,488 ft.

The 1 RUSA-Lederer unit is ½ mile south and slightly east of Artnell's 1 Universal-Richey et al., which was completed in May at 8,077-97 ft. The wells are in Dunnigan Hills gas field.

New Mississippian field opened in North Texas

A new Mississippian oil pool was tapped in southwestern Jack County, North Texas. Discovery well is Bayview Oil Corp. 2 H. C. Gilmore "A," 1 mile south of Finis in the George Dedrick Survey, A-176.

The well flowed 409 bbl. per day on 12/64-in. choke from perforations at 4,624-40 ft. Nearest production to the new Bayex opener is in the Bayex Mississippian field, 2,000 ft. southeast.

Utah's Lisbon field may have new pay zone

Paradox salt Pennsylvanian may be the newest pay in Utah's Lisbon field, a Devonian and Mississippian reservoir of considerable importance to the Paradox basin. Pure Oil Co. 2 USA-C in NE NW 3-30s-24e, San Juan County, flowed oil during test of the zone at 5,926-34 and 6,050-65 ft. Flow was through ¼-in. choke at the daily rate of 54 bbl. Regular field pays were tested but with no results. Location is 1 mile north of the Devonian discovery of Lisbon field.

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FORD DIVISION, Ford Motor Company

Western Canada 1960

	All wells						1959	Wildcats					1959
	Total	Oil	Gas	Dry	Service	Footage	total	Total	Oil	Gas	Dry	Footage	total
Western Canada	2,436	1,459	290	645	42	13,289,001	2,505	634	72	111	451	3,479,386	694
Alberta	1,631	926	250	413	42	10,052,778	1,607	418	43	90	285	2,500,594	423
Saskatchewan	577	426	10	141	0	2,283,350	746	118	20	5	93	485,920	200
Manitoba	68	54	0	14	0	150,424	41	11	2	0	9	34,041	11
British Columbia	141	52	29	60	0	736,921	107	68	7	15	46	393,303	56
Northwest Territories	19	0	1	18	0	65,528	4	19	0	1	18	65,528	4
Ontario	306	42	108	111	45	383,350	265	...	...	...	...	...	...

HOW 116 OIL WELLS WERE PROTECTED FROM CORROSION

Several leaks, caused by external casing corrosion, had already occurred in this Permian Basin field of 116 wells. No previous attempt had been made to stop the corrosion.

To determine the current required for protection, CSI spot checked 25 of the wells—using the "log current potential method" developed and patented by a CSI engineer.

It was found that a maximum of 6 amperes was sufficient to stop corrosion. However, it was decided to use 8-ampere rectifiers as the current source so that there would be a reserve to meet changing requirements caused by weather. In some instances it was found advisable to install 16- and 24-ampere rectifiers to protect 2 or 3 wells in groups.

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Tel. Circle 5-1351

Texas Gulf Coast adds new field

The deep Frio sands in Matagorda County, on the Texas Gulf Coast have come up with another in a long succession of new fields that have been found in recent years.

The new discovery is by J. M. Flaitz and R. B. Mitchell at their 2 W. B. Ferguson, Jr., 8 miles southeast of Bay City, in the eastern part of the county. It is 2 miles northeast of the present limits of the large Wadsworth field.

Completion is in a zone at 10,466-80 ft. with a flow of 254 bbl. of oil daily through chokes. Flowing pressure is 1,375 psi.

Drilling already is under way on a confirmation well at 3 Ferguson with Cities Service Petroleum Co. as the operator.

Frio development also has accounted for another good oil well in the Blessing area, in the northwest part of the county. The well, Texaco Inc. 1 Piller Oil unit, is being completed as a triple completion with production in sands at 6,983 - 88 ft., 7,533 - 34 ft., and 6,983-88 ft. Production in the latter sand, designated as the F-3 zone, confirms a recent discovery. Flow from this zone was at the rate of 189 bbl. daily through 8/64-in. choke. Flowing pressure was 1,325 psi. and gas-oil ratio 815 cu. ft. per bbl. Oil gravity is 45.3°.

The 7,790-ft. F-12 zone flowed 236 bbl of 43°-gravity oil daily through 7/64-in. choke with pressure of 2,000 psi. and gas-oil ratio of 1,572 cu. ft. per bbl. Potential gage on the 7,500-ft. sand has not been reported.

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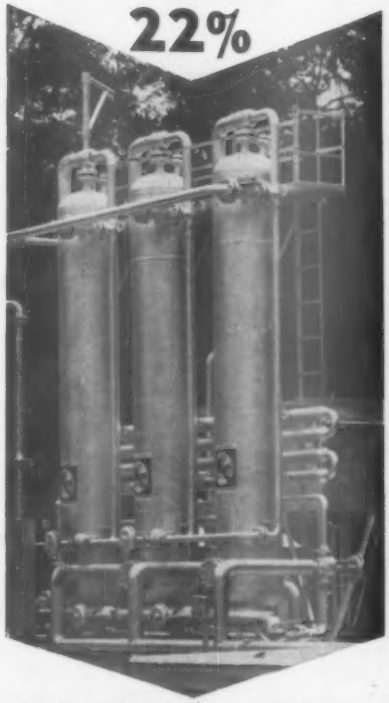

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In the Alco-Mag field near Houston, an operator has installed one of Maloney-Crawford's new three-tower Hy-Sorb quick-cycle recovery units downstream from cold separation. The low temperature separation units are producing a total average of 21.5 Bbls/MMS CF/gas and the Hy-Sorb is increasing stock tank liquids 22 per cent by producing another 4.83 Bbls/MM from the tail gas. The gas volume throughput averages 5.5 MMS CFD/D at 850 pounds pressure. This is a typical field report on Hy-Sorb performance . . . performance that means quick payout. The dry-bed HySorb gives greater efficiency because each of the three towers does only one job at a time. Maintenance and operating costs are low because there are no hot pumps, motors, seals, bearings, etc. Flow is controlled by a single selector. Write for full details.

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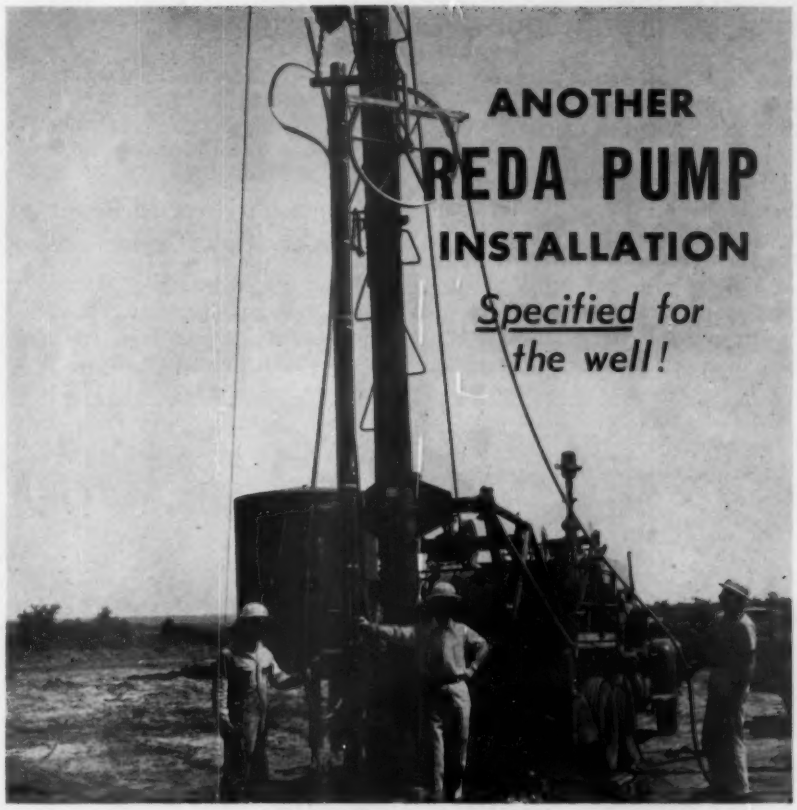

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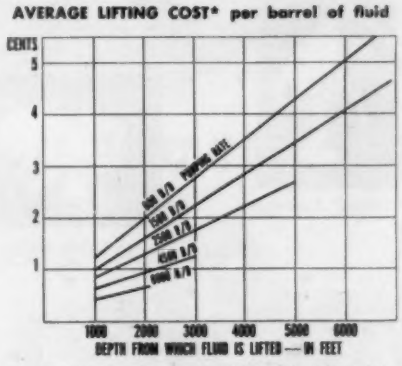

*Included: Electric Energy (10 Mills Per KWH), Run and Pull, Repairs, Upkeep, Transportation, Labor and Amortization (8 Yrs.)

Chart "A"

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First '61 North Louisiana field discovered

A Smackover oil discovery in Claiborne Parish is the first new field to be found this year in North Louisiana.

The new discovery well, drilled by Murphy Corp., is 2 miles from nearest Smackover production, in the East Haynesville area, 2 miles west. It is 2½ miles north of Smackover production in Colquitt field.

The well, 1 Greer, flowed 185 bbl. daily through 9/64-in. choke. Oil-gravity is 49°. Flowing pressure registered 2,510 psi., with gas-oil ratio of 1,390 cu. ft. per bbl.

Pay, in hole drilled to 10,271 ft. and cased to 10,263 ft., is perforated at 9,995-97 ft.

Location is in 10-23n-6w, 3¾ miles north of Colquitt townsite.

Wyoming's Howard Ranch discovery flows Lance gas

Wind River basin's Howard Ranch unit gas discovery is shut in. Shell Oil Co. 23-15 unit, NE SW 15-39n-93w, Fremont County, Wyoming, flowed 2 M.M.c.f.d. and 11 bbl. condensate. Flow was through 1-in. choke from perforations at 8,938-52 ft. in Lance Upper Cretaceous.

This new field is located 11 miles west and north of West Lysite, closest production. A second location in SE SE 8-39n-93w is temporarily suspended at 90 ft.

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Deep gas production found in Sacramento

A new depth record for gas production in California's Sacramento Valley has been established by Honolulu Oil Corp.'s 1 Balsdon unit in North Buckeye field, Colusa County.

The well has a show of gas at 9,577-9,627 ft., which is almost 1,000 ft. deeper than the valley's previous gas production record. The old record was established earlier in January by Artnell Co.'s 1 RUSA-Lederer unit in Yolo County. The Artnell well's production is coming from 8,715-25 ft.

During a drill-stem test, production from the L Balsdon unit stabilized at a rate of 1,350 M.c.f.d. through a ¼-in. choke.

Good wells reported in the Illinois basin area

In Clay County, Illinois, 5 miles north of Sailor Springs, Samuel E. Boxell 1 C. Workman in NW NW NW 32-5n-8e, completed flowing 730 bbl. of oil per day from the McClosky Mississippian at 3,000-16 ft. Southwest of this big well, Gaurd Marvin et al. 1 Leonard "B" Community in SE NW NE 31-5n-8e, pumped 235 bbl. per day from McClosky 2,959-62 ft.

Jefferson County. David F. Herley 1 Cora Marlowe, NE NW SW 3-2s-4e, ¼-mile stepout 7 miles northeast of Mount Vernon, is pumping 165 bbl. per day, natural, from McClosky at 2,926-31 ft.

Richland County. Frank Morrison, Jr., et al., 1-A Brooks, SE SE SE 20-4n-10e, pumped and flowed

1960 Canada footage breakdown

	FIELD WELLS				WILDCATS		
	Oil	Gas	Dry	Service	Oil	Gas	Dry
Western Canada	7,720,782	877,564	981,898	229,371	394,265	626,736	2,458,385
Alberta	5,822,430	795,234	705,149	229,371	284,316	521,642	1,694,636
Saskatchewan	1,596,444	11,321	189,665	.....	77,457	18,063	390,400
Manitoba	107,895	.....	8,488	.....	4,744	.....	29,297
British Columbia	194,013	71,009	78,596	.....	27,748	87,031	278,524
Northwest Territories	.....	.....	.....	.....	.....	4,115	61,413

190 bbl. per day from Rosiclare at 3,019-34 ft.

Saline County. Louis Kapp 1 Wayne Sutton Community, north of Eldorado in SW NW NW 16-8s-7e, flowed 312 bbl. per day through choke after fracture in the Hardinsburg at 2,351-74 ft. This one is located ¾ mile from other similar wells.

White County. Shulman Brothers 1 Stocke Heirs, SE NW SE 24-4s-8e, will test the Aux Vases at 3,325-76 ft. A drill-stem test at 3,315-40 ft. got 90 ft. clean oil, 150 mud-mixed oil. Location is 4 miles northeast of Enfield.

Test abandoned in Ohio's Summit County

In Ohio, Belden & Blake have announced the abandonment of a Cambro - Ordovician test in Bath Township, Summit County, at a depth of 6,101 ft.

Drilling of this test was for a two-fold purpose: (1) To explore this horizon, and (2) determine economic feasibility of deepening a standard completed Clinton well with a 4¾-in. bore.

Selection of 1 J. & S. Laughlin, Lot 21, was made when fracture in the Clinton sand failed to stimulate production in this formation. Also, location was attractive as this well was about 3 miles southeast of the Ohio Fuel Gas Co., East Ohio Gas Co., and Wiser Oil Co. 1 F. Smith, Lot 69, Cambro-Ordovician

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producer in Hinckley Township, Medina County, and these companies were interested in developing additional geological information of this area.

The liner was milled out and rotary tools of Glenn Gillespie & Sons using air and foam deepened the hole from 3,663 ft. to 6,101 ft. Log information is still "tight" but formation tops were released as follows: Trenton, 5,250 ft.; Glenwood, 5,980 ft.; and Trempealeau, 6,000 ft. with small shows of gas and oil indicated in two sections here.

The operators, Belden & Blake have concluded, as a result of this test, that Clinton wells can be drilled to deeper formations, economically.

Discovery wells

CALIFORNIA

Contra Costa County:

McCulloch Oil Corp. 1 Duarte, NW SE NW, 17-2n-1w, flowed 29 M.M.c.f.d. through 1-in. choke with 7.8% pressure drawdown on production test and 170 M.M.c.f.d. absolute open-flow potential through perforations from 3,890-4,235 ft. TD 4,321 ft. New fault block discovery in Los Medanos field.

Monterey County:

Westates Petroleum Co. 44 Doud, SE SE NW 19-19s-7e. Completed on pump, 23-25 bbl. daily with 85% water cut through perforations at 2,025-2,225 ft. TD 3,045. New zone discovery in Monroe Swell field.

WESTERN CANADA

Alberta:

Honolulu 10-12 Perbeck, LSD 10, 12-35-22w4, Blairmore gas discovery. TD 7,235 ft.

Cal-Standard-B.A. 2-28 West Kaybob, LSD 2, 28-63-20w5, Winterburn gas discovery. TD 10,700 ft.

Altair Katex 10-32 Veteran, LSD 10, 32-35-8w4. Viking gas discovery. TD 2,914 ft.

Hamilton 6-32 Birch Lake, LSD 6, 32-49-11w4. Cretaceous gas discovery. TD 2,555 ft.

British Columbia:

Pacific et al. d-97-C Jedney, d-97-C-94-G-8. Triassic gas discovery. TD 7,101 ft.

Sinclair-Pacific et al. d-10G Beg, d-10-G-94-G-1, Halfway and Baldonel was discovery. TD 5,582 ft.

NORTH DAKOTA

Bottineau County, South Westhope area:

Cardinal Petroleum Co. 1 Herman Haugen, C SW NW 10-162n-80w. OWDD, OTD 3,412 ft. IPF 235 BO, 18 hours, cut 0.7% b.s. and w., through tubing, Spearfish 3,406-14 ft. TD 3,423 ft. Spearfish Triassic discovery, new field.

NORTH TEXAS

Acher County, Ferguson Mississippian field:

Tom C. Ferguson et al. 1 Garvey, 10 miles southeast of Archer City in Joseph Levins Sur., A-260. IPF 583 BOPD, 12/64-in. choke, Miss. 5,320-40 ft., TP 950 psi., CP 1,050 psi., 43°, GOR 800:1. TD 5,345 ft. New oil discovery.

Jack County:

Bayex East Mississippian field: Bayview Oil Corp. 2 H. C. Gilmore "A", 1 mile south of Finis in George Dedrick Sur., A-176. IPF 409 BOPD, 12/64-in. choke, Miss. 4,624-40 ft. TP 900 psi., packer 41°, GOR 1,200:1. TD 4,916 ft. New oil discovery.

Young County:

Gulf Oil Corp. 2 Norton Properties "E", 2 miles northwest of South Bend in Sec. 1007, TE&L Sur., A-1236. IPF 930 BOPD, 24/64-in. choke, Miss. open-hole top pay 4,411 ft., TP 940-660 psi., CP 940-800 psi., 43.9°, GOR 633:1. TD 4,418 ft. New oil discovery.

TEXAS PANHANDLE

Hansford County:

Shamrock Oil & Gas Corp. 1 J. I. Steele "D," OWPB, Sec. 64, Blk. 45, H&TC Sur., 10 miles north of Spearman in North Spearman Lansing-Kansas City field. IPF 564 BOPD, 45.4°, GOR 621:1. Lansing shale-lime 5,488-5,522 ft. TD 7,547 ft. Oil discovery.

WEST TEXAS

Victoria County:

Jack H. Pittman and Frank A. Morrison 1 Starry-Martin, Lot 46, Roseborough Ranch Subd., V. Garcia Grant, A-45, 6 miles southeast of Inez. AOF 7,900 M.c.f.d., GLR 340 M.c.f. per bbl., 52°, shut-in TP 2,248 psi., perf 5,912-17 ft., Frio, and 13 M.M.c.f.d., GLR 246 M.c.f. per bbl., 54°, 2,216 psi., perf. 5,409-17 ft., Frio. TD 6,514 ft. Dual discovery well in Witte area.

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But you won't hear any kicks from the newest vice president of Helmerich & Payne, Inc.

"I couldn't design a better job than I have," Toll declares. "There's more stimulation in the oil business than in any other field."

The handsome 6-footer, who's barely 33, moved up to his post just a few weeks ago. Before that, he was assistant to company president W. H. Helmerich III, served as manager of exploration, and was chairman of the executive committee of Engineering Construction Co., a pipelining subsidiary.

Toll's love of the industry sparkles in everything he says about his job. And this dynamic young man on the rise likes nothing better than the challenges of the oil world.

In high gear . . . Toll, an attorney's son, is a native of Denver. When he was 7, the family moved to Washington, D. C. He went to public schools there and later attended the Hill School, Pottstown, Pa.

At Princeton he majored in history, graduating in the top 3% of his class.

Toll won scholarships all the way through Hill and Princeton and collected high academic honors to boot. He worked as a busboy and waiter captain to pay for his board at Princeton.

On leaving college Toll decided he wanted to get into oil, although none of his studies had dealt with the business.

The approach he used was one you'd expect from a comer.

"I'd go see presidents of companies," he recalls. "First, I'd ask how a president got his start. After he told me, I'd ask him for advice on getting mine. Generally he'd give me the name of someone who might hire me.

"Of course, 1949 wasn't a good year for oil and jobs were scarce. That 'Ivy League' tag didn't do me much good, either. Most of the oldtimers remarked that I ought to get myself a hard hat."

Around and about . . . At last Toll got a break—an office job with Deep Rock Oil Corp. in Tulsa. He had worked up to manager's assistant in the product supply department when the Navy called him for Korean War service in 1951.

Toll got a direct commission. He spent 19 months on a destroyer escort in the Pacific and logged a 6-month Korean tour in coastal blockade and bombardment.

After the Navy stint, Toll headed for the Harvard School of Business Administration and a master's degree in that field.

In 1955 Toll joined Helmerich & Payne. He might be fresh from the Harvard School, but the job he got was on a rig outside Watford City, N. D., and he wore that hard hat the oldtimers had mentioned. However, for a youngster determined to make tracks in the industry, the bottom seemed as good a place to gain a foothold as any.

One night Toll's knee was injured in a drilling accident.

"This gave me a chance to retire from the rig," he says with a grin. "I went to Midland as a land man for the company."

Aims and attitudes . . . In talking about Helmerich & Payne, Toll points out that it's mostly known as a contract-drilling company. Actually, he says, oil and gas production heads the roster of activities.

"We feel that a firm of our size, staffed with a lot of young people, should have several growth areas," Toll says. "And as a publicly owned corporation we think we need the stability that diversification provides."

He sums it up this way:

"Our intent is to grow, and to grow as rapidly as practical."

Man of many interests . . . Bachelor Toll has a busy schedule, even after office hours. He has been a singer since his days with the Princeton Glee Club, and keeps up this interest by singing in the Tulsa Opera Chorus. He's the president.

Sailing is one of his chief diversions. He's part owner of a 19-ft. sailboat.

But Toll's main enthusiasm is reserved for his job. He is convinced that the oil industry has everything—"intellectual variety, an air of romance, and the feeling that your product makes a real contribution and meets a basic need."

▶▶▶ Personals

P. H. DuVal has been named manager of Cities Service Petroleum Co.'s natural-gas division. He will move to Bartlesville, Okla., from Shreveport, La., where he has been manager of natural-gas sales and crude-oil supply and transportation for Arkansas Fuel Oil Corp. **William F. Hanagan**, Bartlesville, will continue as superintendent of Cities Service Petroleum's natural-gas division. **C. D. McDaniels,** Arkansas Fuel, has joined the division as gas-contracts engineer.

DUVAL

M. Henry Jamison has been appointed manager of market development in the commercial-development division of Sun Oil Co.'s research and engineering department. **William P. Dooley** has been named marketing specialist in the division.

A. W. Pryor has been promoted to senior research engineer in process and plant design at California Research Corp.'s Richmond, Calif., laboratory. **Dr. Malcolm Bersohn** has been named research chemist in petroleum-process research, Richmond, and **Thomas V. Roland** has been named research chemist, analytical and physical measurements.

Robert E. Chandler has been named district engineer in charge of Oil Recovery Corp.'s new Midland, Tex., district office. The office will work with Orco process licensees in the Permian basin area. Chandler was petroleum engineer with Mobil Oil Co. in Midland before joining Oil Recovery.

J. C. Heggblom, general manager of Gulf Oil Co. of Libya, has been transferred to Nigeria to organize a new Gulf subsidiary, Nigerian Gulf Oil Co. **N. C. Simpson** will succeed Heggblom in Libya.

William L. Abel, petroleum engineer with Pan American Petroleum Corp., has been transferred to Corpus Christi, Tex., from Alvin, Tex.

S. E. White, general superintendent, Dallas, for Texaco Inc., has been appointed assistant Dallas division manager. **J. H. Moore,** division petroleum engineer, will succeed White. **E. F. Egan,** assistant division petroleum engineer, will succeed Moore.

Robert W. Bashe, Schlumberger Well Surveying Corp., has been elected chairman of the Oklahoma City chapter of AIME's Society of Petroleum Engineers. He succeeds **A. E. Hall,** Sohio Petroleum Co. Other officers are **Homer Riley,** Pan American Petroleum Corp., first vice chairman; **Charles Respess,** Western Co., second vice chairman; **Dudley Strother,** Sunray Mid-Continent Oil Co., secretary; **Carl House,** Continental Oil Co., treasurer; and **John Sherwood,** Welex, Inc., and Hall, directors.

N. D. Griswold has been named general manager of Dow Chemical Co.'s new engineering and construction services division in Houston. Griswold had been a Texas division assistant general manager. **R. W. Loomis,** Texas division director of purchases, will head a new regional purchasing office. **A. F. Shorkey,** general superintendent of alkali products, has been named manager of Texas division plant-maintenance services. In the engineering and construction services division, **H. D. Sherbrook** has been named construction manager; **J. E. Ross** and **J. M. Parish** have been named engineering managers; and **A. C. Learned** has been named control section manager. **G. F. McGovney** and **P. J. Gurklis** have been assigned to the construction department. In purchasing, **J. R. Lane** will succeed Loomis as Texas division manager of purchases. **J. V. Stark** will head labor services and project procurement section under Loomis. In plant-maintenance services, a new plant-engineering department has been formed with **E. T. Neill** as manager. **I. W. Carhart** will handle maintenance staff functions and will continue to be responsible for the Texas division instrument and electrical departments.

Harold N. Hickey, chief evaluations geologist for the Calco division of California Oil Co. in New Orleans, has been named professional specialist for the company.

A. C. (Bill) Saul, manager of Shell Oil Co.'s transportation and supplies department, West Coast, has retired after 43 years with the Royal Dutch-Shell companies.

C. C. (Chan) McAllister has joined **R. J. Patrick** as co-owner of Patrick Well Service, Inc., Liberal, Kans., well servicing firm. McAllister will continue as consulting petroleum engineer in Liberal.

Elmer T. Rogers, superintendent of Union Texas Natural Gas Corp.'s Cree-Sykes plant, Ballinger, Tex., has been named superintendent of the Walnut Bend plant, Gainesville, Tex. He succeeds **Harold Snell,** who becomes superintendent of the Cree-Sykes plant.

E. A. Smith, president of Service Drilling Co., Tulsa, has been elected president of Oklahoma Independent Petroleum Association. He succeeds **Paul R. Schultz,** Blackwell Oil & Gas Co. Also elected were **Jack H. Abernathy,** Big Chief Drilling Co., Oklahoma City, vice president; and **John J. Robertson,** Voss Petroleum Corp., Shawnee, secretary-treasurer.

SMITH

R. M. Dost, Kingwood Oil Co., Mount Vernon, Ill., has been elected chairman of the Illinois Basin Section of AIME's Society of Petroleum Engineers. Other new officers are **J. A. McClure, Jr.,** Dowell division of Dow Chemical Co., Mount Vernon, first vice chairman; **Bernard Podolsky,** Fairfield independent, second vice chairman; and **John Stephenson,** Tidewater Oil Co., Robinson, secretary-treasurer. Directors are **Dan Moon,** Schlumberger Well Surveying Corp., Mount Vernon; **E. M. Barnett,** Continental Oil Co., Carmi; **J. A. McCarty,** Shakespeare Oil Co., Salem; and **Carl Sherman,** Illinois Geological Survey, Urbana.

▶▶▶ Personals

Maurice S. Schiller, executive vice president of Speedway Petroleum Corp., has been elected president and a director of the company. He will continue as a vice president of Aurora Gasoline Co., Speedway's parent company. Schiller has been with Aurora since 1939. He was manager of crude-oil exploration and supply in Tulsa before moving to Detroit as Aurora vice president. Schiller succeeds **C. William Sucher** who recently resigned as president of Speedway. Sucher is now chairman of Tulsa Oil Corp., Detroit.

SCHILLER

William L. Naylor, senior vice president of Gulf Oil Corp., will retire February 1 after 40 years with the company.

James R. Britt, vice president of Procon, Inc., subsidiary of Universal Oil Products Co., has been named vice president and general manager of Universal Oxidation Processes, also a UOP subsidiary.

L. W. Finfrock, research and liaison geologist for Sunray Mid-Continent Oil Co. in Tulsa, has been named Gulf Coast division geologist in Houston.

Lawrence C. Brunstrum, section leader in charge of research on greases and industrial lubricants at American Oil Co.'s Whiting, Ind., laboratory, has been named research associate in the research and development department there. **Robert S. Barnes, Jr.,** has been named section leader, greases and industrial lubricants.

Robert F. Matthews, Continental Oil Co. geologist in Roswell, N. M., has been elected president of Southwestern Federation of Geological Societies. He succeeds **W. N. Tindell,** Abilene, Tex., consultant. Other new officers are **Charles Forney,** Champlin Oil & Refining Co., Fort Worth, vice president; **Thomas Hambleton,** Texaco Inc., Midland, Tex., secretary; and **E. A. Hanson,** Roswell, N. M., consultant, treasurer.

W. H. Fowler, assistant sales manager for Pure Oil Co.'s wholesale-marketing division, has moved up to sales manager of the division.

Matthew V. Carson III, geologist with Standard Oil Co. of California, has been transferred to Reno, Nev., from La Habra, Calif.

Bob Bonner, electronic-data analyst with Creole Petroleum Corp. in Venezuela, has joined Continental Oil Co. as senior analyst in the computer department.

James F. Bell, manager of western operations for Socony Mobil Oil Co.'s petroleum - chemicals department, has been named associate manager of new projects for Mobil Chemical Co.'s domestic department.

Jack W. Goddard, manager of exploration for Sunray Oil Co. in Calgary, has been named coordinator of property acquisition for Sunray Mid-Continent Oil Co., the parent company, in Tulsa. **Fred G. Phelps,** chief geologist in Calgary, has been transferred to Tulsa as division geologist. Sunray Oil properties were recently sold to Pacific Petroleums, Ltd. The Calgary Sunray office has been closed and Canadian activities will be handled through the Tulsa general office.

H. L. (Whitey) Weeks has been promoted to superintendent of production for Cosden Petroleum Corp. He will headquarter in the company's general offices, Big Spring, Tex. Weeks had been production superintendent for New Mexico and part of West Texas with headquarters in Penwell, Tex. In Big Spring, he succeeds the late H. T. Bratcher.

Reese H. Tucker, vice president of Cities Service Co., and **Olin R. Prather,** president of White Eagle International, Inc., will serve as a management committee in a joint producing and exploration venture on Astra Cia. Argentina properties in Argentina.

Jay S. Handley, superintendent of Texas Gas Exploration Corp.'s drilling and production department, has been elected vice president in charge of drilling, production, and production engineering. Handley was with Shell Oil Co. and Mobil Oil Co. before joining Texas Gas Transmission Corp., Texas Gas Exploration's parent company. He moved to Texas Gas Exploration in 1956.

Dr. Gilbert B. Carpenter has joined Mobil Chemical Co. as technical adviser. He will headquarter in the Rotterdam office of Mobil Oil Nederland N. V. and will advise Mobil Chemical on expansion of production and research activities in the U. S. and abroad.

Ellis K. Locher, assistant manager of Ethyl Corp.'s central region, Chicago, has been named manager of the new Gulf Coast region, Houston. **J. O. Balzer,** assistant manager of the Mid-Continent region, Tulsa, has been named assistant manager, Gulf Coast region. Others appointed to the Gulf Coast region are **W. S. Eskridge,** operations manager; **Donald D. Hornbeck,** chief refinery technologist; and **Kenneth C. Jost,** chief product-service engineer. **J. E. Hendrick** will continue as manager of the Houston district, and **Douglas P. Jeppe** will continue as New Orleans district manager. **Norman J. Linstromberg** has succeeded Locher in the central region, and **Laurence D. Reis** has succeeded Balzer in the Mid-Continent region. **I. E. Flaa,** Tulsa; **Albert H. Bingham,** Cleveland; and **Alfred T. Basye,** Kansas City, are new district managers. **Merrill J. Anderson** has succeeded Bingham as account representative in Cleveland. Six men have been named to the new posts of national accounts managers. They are **Donald J. Chapman** and **Gelston Howell,** New York; **Paul R. Harris,** Chicago; **A. Dale Miller** and **Lowell A. Dollahan,** Tulsa; and **Marshall D. McDorman,** Houston.

Personals

W. W. Keeler, executive vice president of Phillips Petroleum Co., has been granted leave by his company to serve as a special consultant on Indian affairs to Secretary of Interior **Stewart Udall.** Keeler, principal chief of the Cherokee Nation since 1949, will leave for Washington early next month for a possible 3-months' tour of duty. Keeler has been prominent in both Indian and oil affairs in Washington. He has served for many years as chairman of the Military Petroleum Advisory Board and last year was a member of the American group of oil men who toured the Russian oil industry.

KEELER

J. D. McMahan, Mobil Oil Co., has been elected president of the Gulf Coast Oil Scouts Association. Other officers are **J. T. Thaemer,** Humble Oil & Refining Co., first vice president; **Kelly Scott,** Superior Oil Co., second vice president; and **Bill Huggins,** Sun Oil Co., editor. **Nick Angelos,** Union Producing Co., is bull scout for the check, and **W. L. Miller,** Superior, is secretary-treasurer.

R. F. Storey, currently on foreign assignment for Shell Oil Co., will become Alaska division exploration manager for the company around March 1. He will succeed **V. W. Finch,** who has retired.

Jim Merritt has been transferred by Belco Petroleum Corp. from Big Piney, Wyo., to Grand Junction, Colo., where he will be district geologist.

E. W. Lang, R. D. White and **J. L. Zust** have been named sales vice presidents for Cities Service Oil Co. Other officers named by the new marketing affiliate of Cities Service Co. include **L. W. Knight,** administrative vice president; **W. G. Swartz, Jr.,** vice president, operations; **Tom DeBow,** vice president, advertising and promotion; **E. G. Maddock,** vice president, marine operations; **J. B. Turner,** vice president, Orange State division; and **R. A. Cuthbertson,** secretary-treasurer. Members of the board include **F. M. Simpson,** president of Cities Service Oil; **John D. King,** executive vice president; **John A. Welch,** vice president; Lang; White; Zust; Swartz; DeBow; Knight; and, additionally, six executives of the parent company. They are **J. Ed Warren,** president; **A. P. Frame, C. S. Mitchell,** and **George H. Hill, Jr.,** senior vice presidents; and **E. G. Christian** and **E. L. Stauffacher,** vice presidents.

GRIFFIN

Aaron H. Griffin has been named manager of Texas Gas Transmission Corp.'s Louisiana division with headquarters in Lake Charles. He succeeds **W. O. Davis,** now manager of the pipeline department of the Memphis division office. Griffin was assistant superintendent of the dispatching department in Owensboro, Ky., before his new assignment.

Eric S. Davis, operations manager of Trans Mountain Oil Pipe Line Co., and **R. F. Bruce Taylor,** treasurer, have been named vice presidents of Trans Mountain and its subsidiaries. Davis was assistant superintendent of the Imperial Oil Ltd. Winnipeg refinery before joining Trans Mountain in 1953 as general superintendent. Taylor was financial advisor for Trans Mountain on the staff of Canadian Bechtel, Ltd., before joining the pipeline firm.

Franklin Dartez, evaluation engineer with Cities Service Petroleum Co., has been transferred to Bartlesville, Okla., from Shreveport, La.

S. Brooks Stewart, Houston division geophysicist with Sohio Petroleum Co., has opened consulting offices in Houston.

Deaths

Buell Abney, 61, Mount Carmel, Ill., independent operator was fatally injured January 10 in a rig accident on a Lawrence County, Illinois lease.

J. O. Shaffer, 76, retired Owasso, Okla., drilling contractor, died January 17 at his home in Skiatook, Okla. Shaffer entered the drilling business in 1905. He retired 6 years ago.

Ralph T. Zook, 71, Bradford, Pa., oil man, died recently in Scottsdale, Ariz., where he had gone on vacation. Zook was a past president of Independent Petroleum Association of America, Pennsylvania Grade Crude Oil Association and the Bradford District Oil Producers Association.

Harry H. Magee, 62, Oakland, Calif., independent operator and founder of Trico Oil & Gas Co., Oakland, died January 10. He suffered a heart attack while on a hunting trip near Marysville, Calif.

Charles Nolan Beyrle, Jr., 38, drilling foreman for Standard Oil Co. of California in Alaska, was killed January 10 in an auto accident in the Swanson River oil fields. He had been with the company since 1948.

Edward Block, 58, senior vice president, a director, and general manager of the chemicals division of Olin Mathieson Chemical Corp., died January 4 in a Baltimore hospital of a heart ailment. Block was secretary - treasurer of Blockson Chemical Co. when it was acquired by Olin Mathieson in 1955.

Edmund C. Hitchcock, 78, Midland, Tex., independent operator, died January 8 in a Midland hospital.

Orley Jennings Barnes, 62, retired foreman for Western Gulf Oil Co., died January 11 at his home in Bakersfield, Calif.

Suspension bridge for huge pipeline designed for safety with USS Tiger Brand Wire Rope

Carnegie Natural Gas Company reports that this is the largest pipeline for gas transmission ever carried over a suspension bridge. It consists of twin parallel pipes each having a 54.5-inch inside diameter for 7.9 miles. The remainder of the pipe is 42.5-inches I.D. for 4.3 miles. The pipeline originates at the Clairton, Pa. Coke Works of United States Steel and terminates at the Homestead Steel Works.

The main span of the bridge uses two USS Tiger Brand Galvanized Bridge Strands each 2¾ inches in diameter, 367 feet long and composed of 175 wires. The vertical and diagonal supports are made from ⅝-inch diameter 6 x 7 extra galvanized bridge rope with strand core. The pipe is anchored to steel beams with ½-inch diameter 7-wire galvanized Amerstrand with a clevis-type swedge fitting on one end and a threaded-type swedge fitting on the opposite end.

In addition to the bridge strand ropes used for the bridge, all wire rope used on the pipe laying equipment was also Tiger Brand. For information about any type of wire rope, strand or slings write Dept. 1110, American Steel & Wire Division, 614 Superior Ave., N.W., Cleveland 13, Ohio.

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Pipeline suspension bridge built with USS Tiger Brand ropes and strand for utmost safety.
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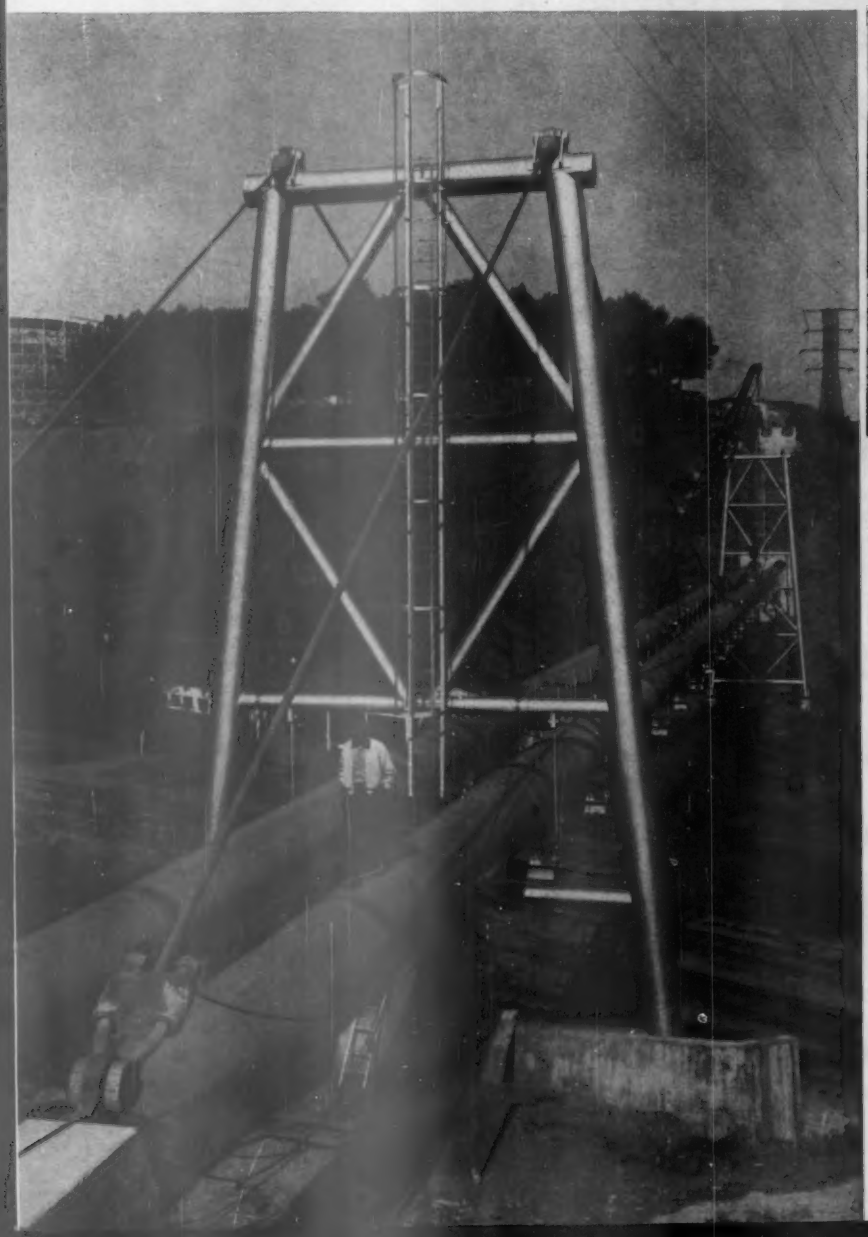

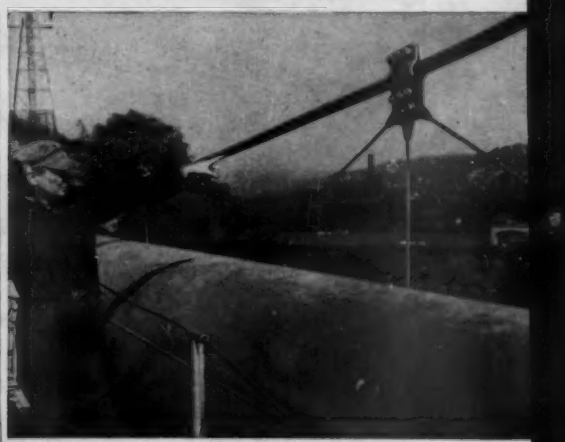

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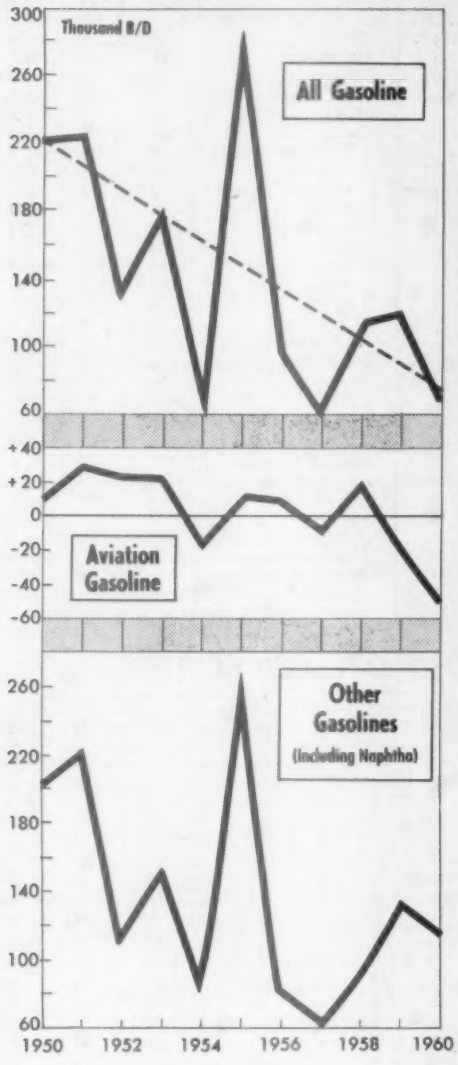


Gasoline demands are shrinking

Diminishing use of avgas is factor in the general slowdown of U. S. demand.

BY JOHN C. CASPER

IF THE GASOLINE demand trend that has been developing for the past 10 years were to continue for the next 6 years, this country would be showing regular annual decreases instead of annual gains.

Sharp reduction in consumption of aviation gasoline over the past 2 years has been a factor in the general slowdown in total domestic demand for gasoline. Sharp increases in automotive use may hide the effect of shifts in aviation demand, but for the past 2 years the relatively small gains in automobile use have tended to highlight the influence of aviation.

Except for the period of rationing during World War II, there has not been a decrease in domestic demand for gasoline motor fuel since 1932. But there have been 3 years when annual gains were very small. The year 1960 was one of these.

The top chart shows annual increases in domestic demand for all gasoline, including automotive, aviation, and a small amount of light naphtha. Note the three low points. The smallest gain over the past 10 years was in 1957 when the over-all increase averaged only 65,000 bbl. daily. Next-to-the-lowest gain was in 1954 when the net addition was 68,000 bbl. daily.

Last year was the third-lowest annual increase. Bureau of Mines' data for 10 months combined with weekly figures from API indicate total demand of about 4,167,000 bbl. daily. Exports averaged about 39,000 bbl. daily with domestic demand accounting for 4,128,000 bbl. daily. That total represents a gain of only 73,000 bbl. daily over the total for 1959.

Note that the three low gains were in years when aviation gasoline demand showed decreases. In the year 1954, relatively small increases in use of automotive gasoline combined with an actual decrease in aviation to give the first low point on the top graph. This same combination resulted in the low point for 1957.

Aviation-gasoline demand showed another loss in 1959, but the sharp increase by automotive gasoline, amounting to about 135,000 bbl. daily, produced an over-all gain of 121,000 bbl. daily.

The 1960 position was due to a combination of smaller increase by automotive and a direct loss in demand for aviation. Automotive and naphtha demand gained only about 119,000 bbl. daily compared with an increase of 135,000 bbl. daily in 1959.

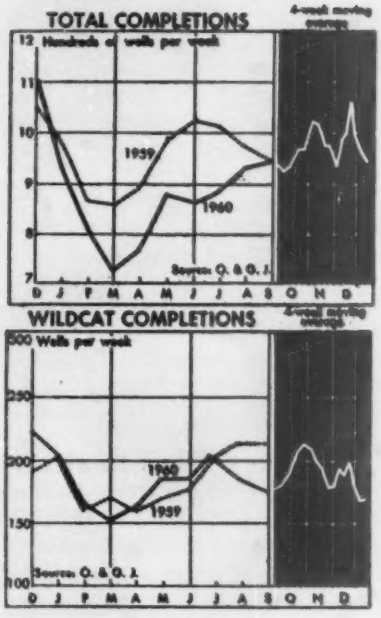
Avgas demand showed a direct loss of about 46,000 bbl. daily on top of the loss of 14,000 bbl. daily in 1959. The combined result of a smaller gain by automotive and a loss for avgas was a sharp drop in the gain for total gasoline.

The straight line on the top chart is the calculated trend line for annual changes in domestic demand for gasoline. Over the past 10 years the average annual gain in gasoline demand has been getting smaller by about 14,200 bbl. daily per year.

Since it was only 73,000 bbl. daily in 1960, a series of six annual cuts of 14,200 bbl. daily would drop the gain below zero. That means a loss.

A quick look at the highlights . . .

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	7,139,240	DOWN	14,855	DOWN	102,160
Crude stocks	237,632,000	DOWN	1,100,000	DOWN	11,278,000
Completions	882	DOWN	153	DOWN	259
Refinery runs	8,342,000	UP	175,000	UP	40
Gasoline stocks	200,269,000	UP	492,000	UP	3,755,000
Kerosine stocks	29,546,000	DOWN	1,168,000	UP	2,963,000
Distillate stocks	127,567,000	DOWN	6,408,000	DOWN	10,972,000
Residual stocks	45,290,000	UP	28,000	DOWN	5,973,000
Four-product stocks	402,672,000	DOWN	7,056,000	DOWN	10,227,000
Total imports	2,139,800	UP	167,200	UP	360,000



Active Rotary Rigs

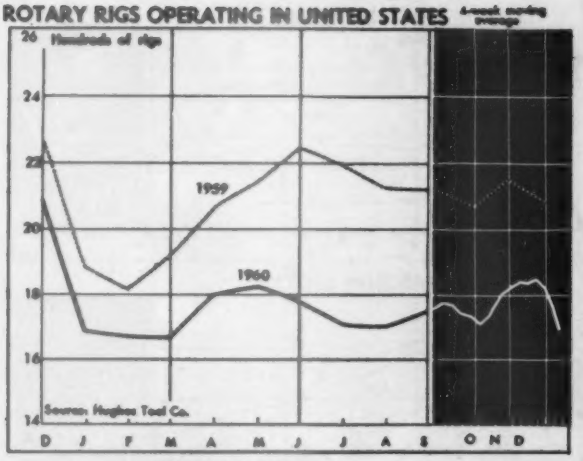
	1-16-61	1-9-61	1-18-60
Alabama	7	7	5
Alaska	7	7	(†)
Arkansas	14	13	14
Arizona	1	1	0
California	77	79	68
Land	73	75	62
Offshore	4	4	6
Colorado	35	31	30
Florida	5	5	1
Land	3	3	1
Offshore	2	2	0
Georgia	2	2	0
Illinois	30	21	31
Indiana	5	9	3
Iowa	0	0	1
Kansas	94	98	111
Kentucky	4	4	6
Louisiana	258	258	282
North	23	28	28
S. Inland waters	90	92	107
S. Land	90	89	92
Offshore	55	49	55
Michigan	21	27	32
Mississippi	48	47	70
Missouri	0	0	1
Montana	23	32	13
Nebraska	13	14	21
Nevada	1	1	0
New Mexico	87	101	94
New York	1	1	0
North Dakota	14	13	20
Ohio	4	4	4
Oklahoma	171	181	169
Oregon	1	1	0
Pennsylvania	8	10	13
South Dakota	0	0	5
Texas	541	575	539
S. Inland waters	8	8	5
S. Land	147	160	163
Offshore	2	4	0
North	43	44	109
Panhandle	59	50	(*)
East	44	44	(*)
West Central	‡137	‡163	168
West	101	102	94
Utah	28	28	27
Washington	1	1	1
West Virginia	3	4	4
South Dakota	0	1	0
Wyoming	55	54	52
Total U. S.	1,559	1,630	1,617
Western Canada	160	162	231
Eastern Canada	0	0	4
Grand total	1,719	1,792	1,852

Hughes Tool Co. report. *Included in North. Comparisons not available due to change in method of reporting. †Data first reported 4-4-60. ‡Stephens and Eastland counties now included in West Central.

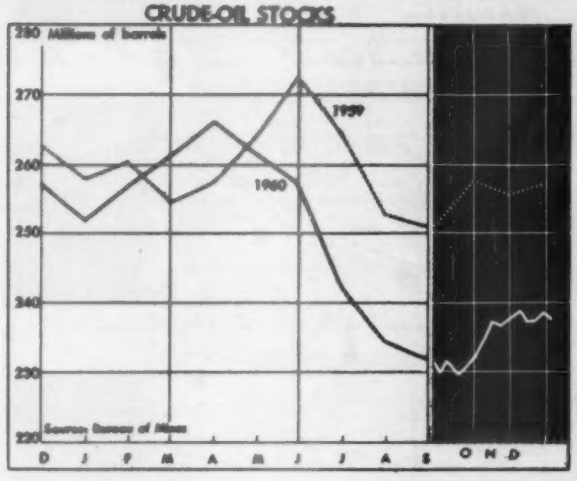
WEEKLY WELL COMPLETIONS . . . WEEK ENDED JANUARY 14, 1961

	Total wells							Cum.		Total wildcats					Cum.	
	Total	Crude	Cond.	Gas	Dry	Service	Footage	1961	1960	Total	Crude	Cond.	Gas	Dry	1961	1960
Arkansas	8	1	0	1	6	0	33,902	19	32	3	0	0	0	3	9	10
California	59	40	0	4	15	0	225,092	113	100	8	1	0	1	6	14	26
Colorado	9	1	0	1	7	0	46,582	22	33	4	0	0	0	4	12	21
Illinois	52	22	0	1	22	7	99,377	89	89	14	1	0	1	12	23	17
Indiana	16	3	0	0	12	1	20,502	37	50	4	0	0	0	4	8	17
Kansas	131	70	0	12	45	4	385,254	238	159	30	2	0	2	26	55	50
Kentucky	20	4	0	0	16	0	20,276	57	96	0	0	0	0	0	5	11
Louisiana	156	80	17	8	51	0	1,447,492	266	207	19	2	1	0	16	41	28
North	29	14	0	4	11	0	83,004	90	71	5	1	0	0	4	19	12
South	98	52	12	0	34	0	1,037,618	137	103	14	1	1	0	12	22	15
Offshore	29	14	5	4	6	0	326,870	39	33	0	0	0	0	0	0	1
Michigan	25	6	0	0	19	0	74,924	36	41	17	0	0	0	17	18	14
Mississippi	19	3	2	0	14	0	175,054	41	46	6	0	0	0	6	16	18
Montana	8	2	0	0	6	0	33,371	14	14	3	1	0	0	2	7	8
Nebraska	13	5	0	0	8	0	67,057	26	40	5	0	0	0	5	12	16
New Mexico	23	17	0	2	4	0	128,221	51	124	4	2	0	0	2	9	13
West	11	7	0	2	2	0	57,625	26	43	1	0	0	0	1	5	2
East	12	10	0	0	2	0	70,596	25	81	3	2	0	0	1	4	11
New York	28	15	0	0	2	11	37,100	87	25	0	0	0	0	0	0	2
North Dakota	2	0	0	0	2	0	11,997	7	17	1	0	0	0	1	1	4
Ohio	18	7	0	4	6	1	53,962	35	97	1	0	0	0	1	1	3
Oklahoma	39	18	0	2	11	8	139,178	144	161	1	0	0	1	0	12	36
Pennsylvania	50	16	0	15	9	10	157,650	50	6	4	0	0	1	3	4	2
Texas	152	67	16	14	52	3	885,705	471	1,054	31	3	2	1	25	89	229
Dist. 1	13	5	0	0	8	0	43,265	27	79	7	0	0	0	7	11	29
Dist. 2	17	2	2	6	7	0	100,034	34	52	2	0	0	0	2	2	13
Dist. 3	25	7	5	1	12	0	192,649	57	118	3	0	0	0	3	11	21
Dist. 4	35	7	5	7	16	0	220,204	59	123	13	2	2	1	8	20	32
East	0	0	0	0	0	0	0	37	89	0	0	0	0	0	8	28
Dist. 7-B	0	0	0	0	0	0	0	58	122	0	0	0	0	0	11	41
West	45	32	4	0	7	2	259,173	104	271	4	1	0	0	3	15	33
Dist. 9	0	0	0	0	0	0	0	46	169	0	0	0	0	0	8	30
Dist. 10	17	14	0	0	2	1	70,380	49	31	2	0	0	0	2	3	2
Utah	6	0	0	1	5	0	30,350	9	10	5	0	0	0	5	7	4
West Virginia	16	4	0	9	3	0	35,912	42	45	0	0	0	0	0	0	1
Wyoming	21	8	0	2	11	0	88,634	43	47	7	0	0	0	7	18	26
Misc. (Ariz., Nev., S. D.)	11	0	0	0	11	0	20,971	20	22	10	0	0	0	10	16	18
Total U. S.	882	389	35	76	337	45	4,218,563	1,917	2,515	177	12	3	7	155	377	574
Previous week	1,035	491	41	104	348	51	4,131,752			200	15	2	8	175		
Cum. 1961	1,917	880	76	180	685	96	8,350,315			377	27	5	15	330		
Cum. 1960	2,515	1,140	123	197	970	85	11,394,181			574	48	10	16	500		
Western Canada	41	29	0	6	6	0	231,601	107	35	4	0	0	3	1	26	7

ROTARY RIGS OPERATING IN UNITED STATES



CRUDE-OIL STOCKS



CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

	1-7-61	12-31-60	1-9-60
Pennsylvania	2,168	2,208	2,293
Other Appalachian	1,367	1,152	2,101
Illinois, Indiana, Michigan	8,309	8,599	9,787
Nebraska and North Dakota	2,863	2,678	2,826
Kansas	8,912	8,762	9,552
Oklahoma	15,479	15,527	16,853
Arkansas	1,711	2,005	2,084
Louisiana	19,468	20,148	17,516
North	3,178	3,011	3,304
South	16,290	17,137	14,212
Mississippi, Alabama, Florida	1,885	1,840	2,531
New Mexico	7,454	7,749	7,992
Texas	99,702	101,903	106,408
East Texas	7,938	7,728	8,051
West Texas	45,204	46,424	49,328
Texas Gulf	18,067	18,320	19,603
Other Texas	28,493	29,431	29,426
Wyoming	17,166	17,150	16,933
Other Rocky Mountain	10,385	10,113	9,686
California	25,072	25,314	29,021
Foreign	†15,691	13,584	13,327
Total	237,632	238,732	248,910

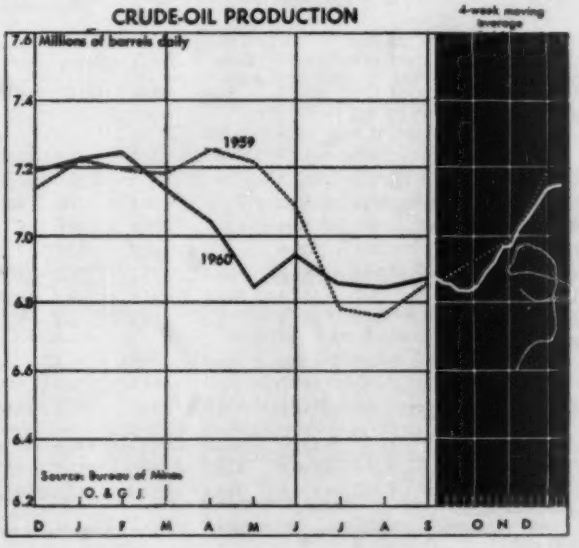
*Bureau of Mines. †Includes 5,126,000 bbl. in California.

DAILY AVERAGE PRODUCTION FOR WEEK

	Jan. 14, 1961 Crude oil	Lease condensate	Total	Jan. 7 total
Alabama	21,100	.....	21,100	21,000
Alaska	6,475	.....	6,475	6,475
Arkansas	74,800	150	75,000	74,900
California	836,400	.....	836,400	835,300
Colorado	132,000	.....	132,000	132,700
Eastern	36,800	.....	36,800	33,600
Florida	1,000	.....	1,000	1,000
Illinois	216,300	.....	216,300	216,000
Indiana	33,100	.....	33,100	32,700
Kansas	†290,865	.....	†290,865	†294,270
Kentucky	59,200	.....	59,200	59,200
Louisiana	982,000	137,900	1,119,900	1,119,800
North	104,000	5,400	109,400	109,300
South	878,000	132,500	1,010,500	1,010,500
Michigan	48,800	.....	48,800	48,400
Mississippi	146,800	4,150	150,950	150,950
Montana	79,500	.....	79,500	80,500
Nebraska	65,300	.....	65,300	65,000
Nevada	100	.....	100	100
New Mexico	285,000	8,200	293,200	293,200
North Dakota	69,000	.....	69,000	70,600
Oklahoma	†503,950	.....	†503,950	†517,400
Texas	2,512,000	97,850	2,609,850	2,609,850
Dist. 1	42,000	3,700	45,700	45,700
Dist. 2	106,000	8,600	114,600	114,600
Dist. 3	321,000	39,000	360,000	360,000
Dist. 4	179,000	15,000	194,000	194,000
Dist. 5	27,000	500	27,500	27,500
Dist. 6	112,000	10,000	122,000	122,000
East Texas field	133,000	.....	133,000	133,000
Dist. 7-B	127,000	400	127,400	127,400
Dist. 7-C	115,000	3,500	118,550	118,550
Dist. 8	1,056,000	12,000	1,068,000	1,068,000
Dist. 9	193,000	2,500	195,500	195,500
Dist. 10	101,000	2,600	103,600	103,600
Utah	110,600	.....	110,600	109,700
Wyoming	379,100	.....	379,100	380,700
Others	‡750	.....	‡750	‡750
Total U. S.	6,890,990	248,250	7,139,240	7,154,095
Change from prev. week, down		.....	14,885	.....
Canada	†598,000	.....	†598,000	†518,700
Total U. S. prod.—Jan. 1-Jan. 14				100,053,345 bbl.
Same period last year (crude plus cond.)				*101,020,500 bbl.

*Includes 3,022,200 bbl. condensate. †Week ended previous Monday. ‡South Dakota and Arizona.

CRUDE-OIL PRODUCTION



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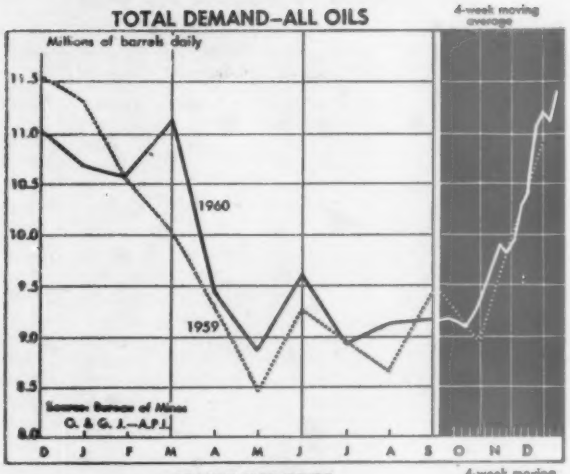
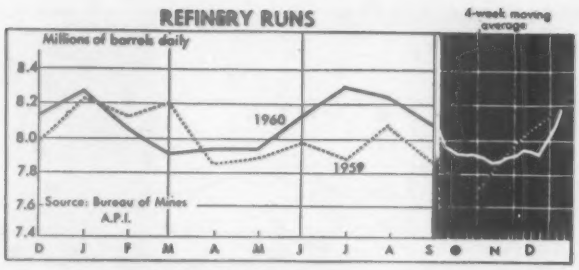
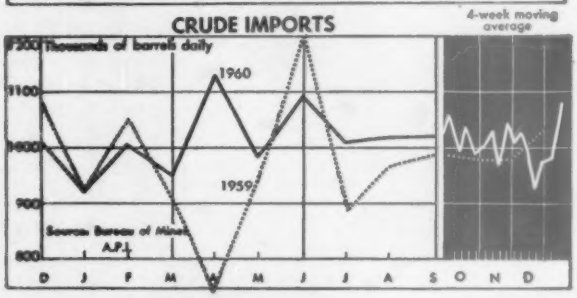
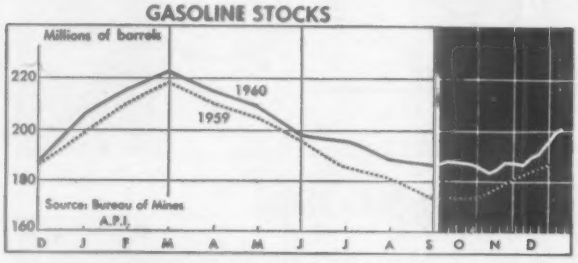
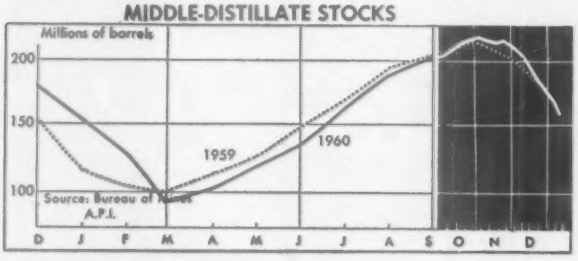
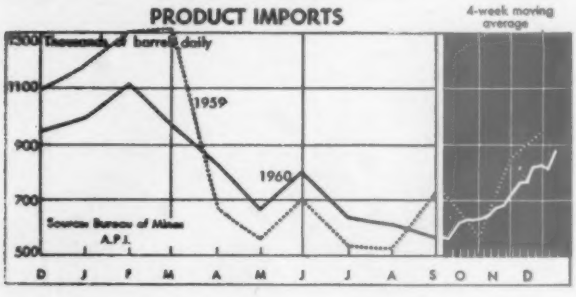

TOTAL DEMAND—ALL OILS
4-week moving average
Millions of barrels daily
1960
1959
Source: Bureau of Mines
O. & G. J.—A.P.I.
D J F M A M J J A S O N D

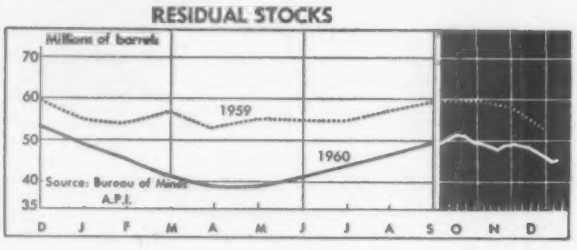












API REFINERY REPORT—JANUARY 13, 1961

(Thousands of barrels)

District—	Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.	Stocks‡—Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, January 1960—Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.
East Coast	1,115	511.3	20.4	407.6	155.1	43,484	11,641	46,615	12,684	1,123	493.3	39.9	322.2	160.7
Appalachian:														
District 1	103	48.3	6.0	23.0	13.9	5,660	726	3,307	565	103	39.3	4.0	23.5	15.5
District 2	100	48.9	4.3	20.7	12.9	2,827	395	1,678	363	108	54.6	7.9	20.8	17.4
Ind., Ill., Ky.	1,535	762.7	79.1	388.6	189.0	33,958	6,207	22,435	6,167	1,569	801.6	82.2	364.0	238.1
Minn., Wis., Dak.	132	66.0	5.1	30.1	21.0	6,875	1,121	6,799	645	125	59.9	7.5	26.6	21.7
Okla., Kans., Mo.	783	433.9	24.9	209.6	19.0	18,122	1,284	11,146	929	761	411.5	15.7	206.8	31.4
Inland Texas	294	208.4	11.1	47.7	18.9	7,383	546	1,554	2,498	302	211.1	10.9	52.3	22.6
Texas Gulf Coast	1,965	985.3	168.4	511.1	121.7	29,581	3,011	11,252	5,440	1,937	974.5	150.1	487.6	158.8
La. Gulf Coast	707	367.7	82.4	147.7	49.1	10,698	1,734	4,881	1,370	691	362.1	78.9	151.3	53.9
N. La. and Ark.	107	64.4	4.3	18.6	5.4	5,781	966	2,332	135	103	71.5	6.8	22.5	8.7
Rocky Mountain:														
New Mexico	12	8.7	0.6	2.4	1.3	803	42	106	10	24	13.4	0.1	4.4	2.3
Other	287	145.7	5.7	64.6	30.0	6,433	331	2,536	1,037	297	142.5	3.3	69.3	35.5
West Coast	1,202	514.1	30.1	205.7	303.3	28,664	1,542	12,926	13,447	1,136	548.4	29.7	180.1	280.2
Jan. 13, 1961	8,342	4,165.4	442.4	2,077.4	940.6	200,269	29,546	127,567	45,290	8,279	4,183.7	437.0	1,931.4	1,046.8
Jan. 6, 1961	8,167	4,190.4	478.7	1,896.0	952.6	199,777	30,714	133,975	45,262	.....	.....	.....	.....	.....
Jan. 15, 1960	8,302	4,154.9	389.1	1,952.4	1,018.1	196,514	26,583	138,539	51,263	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

Crude-Oil Prices

GRAVITY SCHEDULE

	Signal Hill, Calif.	Oklahoma	West Tex. (saur)	West Tex. (Inter.)	No.* Texas	Texas Refugio Light	Bayou Sale (La.)	Denver Julesburg	Wyo. (saur)
14-14.9	$1.86	....	....	....	....	....	....	....	....
15-15.9	1.93	....	....	....	....	....	....	....	1.81
16-16.9	2.00	....	....	....	....	....	....	....	1.86
17-17.9	2.06	....	....	....	....	....	....	....	1.96
18-18.9	2.13	....	....	....	....	....	....	....	1.96
19-19.9	2.20	....	....	....	....	....	....	....	2.01
20-20.9	2.27	$2.49	$2.35	$2.61	$2.29	$2.95	$2.90	$2.58	2.06
21-21.9	2.33	2.52	2.38	2.63	2.33	2.97	2.92	2.60	2.11
22-22.9	2.40	2.55	2.41	2.65	2.37	2.99	2.94	2.62	2.16
23-23.9	2.46	2.58	2.44	2.67	2.41	3.01	2.96	2.64	2.21
24-24.9	2.53	2.61	2.47	2.69	2.45	3.03	2.98	2.66	2.26
25-25.9	2.60	2.64	2.50	2.71	2.49	3.05	3.00	2.68	2.31
26-26.9	2.67	2.67	2.53	2.73	2.53	3.07	3.02	2.70	2.36
27-27.9	2.74	2.70	2.56	2.75	2.57	3.09	3.04	2.72	2.49
28-28.9	2.81	2.73	2.59	2.77	2.61	3.11	3.06	2.74	2.54
29-29.9	2.87	2.76	2.62	2.79	2.65	3.13	3.08	2.76	2.59
30-30.9	2.93	2.79	2.65	2.81	2.69	3.15	3.10	2.78	2.63
31-31.9	3.00	2.82	2.68	2.83	2.73	3.17	3.12	2.80	2.67
32-32.9	3.06	2.85	2.71	2.85	2.77	3.19	3.14	2.82	2.71
33-33.9	3.12	2.88	2.74	2.87	2.81	3.21	3.16	2.84	2.75
34-34.9	3.17	2.91	2.77	2.89	2.85	3.23	3.18	2.86	2.79
35-35.9	3.22	2.94	2.80	2.91	2.89	3.25	3.20	2.88	2.83
36-36.9	3.27	2.97	2.83	2.93	2.93	3.27	3.22	2.90	2.87
37-37.9	3.31	2.99	2.86	2.95	2.95	3.29	3.24	2.92	2.89
38-38.9		3.01	2.89	2.97	2.97	3.31	3.26	2.94	2.91
39-39.9		3.03	2.92	2.99	2.99	3.33	3.28	2.96	2.93
40-44.9		3.05	2.95	3.01	3.01	3.35	3.30	2.98	2.95

*Cooke, Grayson, Montague.

Flat Prices

Louisiana:
- Sweet Lake $3.00

Texas:
- East Texas 3.05-3.25
- Conroe 3.23-3.53
- Van 3.08

Pennsylvania Grade:
- Bradford $4.75-4.80
- Middle District 4.52
- Southwest Pennsylvania 4.25
- West Virginia 4.17
- Buckeye Grade 4.08

Illinois Basin **3.00-3.05**

Foreign

Middle East, Persian Gulf: (cargoes f.o.b. lifting port)
- Arabian, 34.0°-34.9°, Ras Tanura $1.80
- Iranian, 34.0°-34.9°, Bandar Mashur 1.78
- Iranian, 34.0°-34.9°, Abadan 1.73
- Iraq, 35.0°-35.9°, Fao 1.72
- Kuwait, 31.0°-31.9°, Mina-al-Ahmadi 1.59
- Qatar, 41.0°-41.9°, Umm Said 1.95

Middle East, E. Mediterranean:
- Arabian, 34.0°-34.9°, Sidon $2.17
- Iraq, Mosul-Kirkuk, 35.0°-35.9°, Tripoli 2.19

Far East (cargoes, f.o.b. Lutong, Sarawak):
- Seria Light, 36° 2.42

Canada:
- Leduc-Woodbend $2.53
- Redwater (Alta.) 2.42
- Weyburn (light) 2.06
- Midale C 1.69

Venezuela:
- Cumbarebo, 47°-47.9°, Tucupido 3.34
- San Joaquin, 40°-40.9°, Puerto La Cruz 3.08
- Oficina, 35°-35.9°, Puerto La Cruz 2.80
- Tia Juana medium, 26°-26.9°, Amuay* 2.30
- Quiriquire, 16.0-16.4°, Caripito 2.10
- Lagunillas heavy, flat, Las Piedras* 2.10
- Bachaquero, flat, 15°-16°, Las Piedras* 1.88

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

Tanker Rates (Long Ton)

(Latest reported spot fixtures)

- ★ Gulf-NY, dirty (ATRS+32%) $3.76
- ★ Gulf-NY, clean (ATRS+40%) 3.99
- ★ Carib.-NY, dirty (ATRS−45%) 1.51
- ★ PG-NY, dirty (USMC−65%) 4.45
- ★ PG-UK, dirty (Scale−42.5%) (33s. 9d.) 4.73

★Denotes change from previous week.

Refined-Product Prices

Following quotations are realistic spot prices for refined products moving interstate on Wednesday each week. They may differ from refiners' posted prices and should not be considered as postings.

Light-product prices are in cents per gallon. Residual and crude prices are dollars per barrel. Crude prices are at the well unless otherwise listed.

Gasoline*

Mid-Continent (Group 3):
- Regular (91 octane) 12.25-12.50
- Premium (99 octane) 15.00-15.25
- Natural gasoline (26-70) 4.5
- Breckenridge 4.0

Gulf Coast (cargoes for coastwise or export movements):
- Regular (90 octane) 11.00
- Regular (92 octane) 11.25
- Premium (98 octane) 12.25

California (rack) Los Angeles:
- Regular (90 octane) 11.30
- Premium (95 octane) 12.30
- Premium (100 octane) 13.80

Caribbean area (cargoes):
- Regular (87 octane) 10.125-10.25
- Premium (97 octane) 11.75

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

Kerosine and Distillate

Mid-Continent (Group 3):
- Kerosine 42-44 ..... 10.875
- Diesel oil (58 d.i. and above) 10.50
- Distillate No. 1 ..... 10.50
- Distillate No. 2 ..... 9.50

Gulf Coast (cargoes):
- ★ Kerosine 41-43 ..... 9.75
- ★ Distillate No. 2 ..... 9.00

New York Harbor (barges):
- Kerosine 42-43 ..... 11.15
- Distillate No. 2 ..... 10.15
- Diesel fuel, 48-52 d.i. 10.55

Caribbean area (cargoes):
- Distillate No. 2 ..... 8.125

Residual Fuel (Bbl.)

Mid-Continent (Group 3):
- Residual fuel (max 1% S) $1.90

Gulf Coast (cargoes):
- Bunker C fuel 2.30

New York Harbor (barges):
- Bunker C fuel 2.52

Caribbean (cargoes):
- Bunker C 2.10

California (rack):
- Bunker C fuel, Los Angeles 2.25

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Tulsa, Oklahoma

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HELP WANTED

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Midwest Refinery wants experienced chemist to carry out research and development programs on wax modification. Send detailed resume including salary requirements, in confidence, to:

Box M-248, The Oil and Gas Journal
Tulsa, Oklahoma

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Box M-249, The Oil and Gas Journal
Tulsa, Oklahoma

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SITUATIONS WANTED

PROCESS ENGINEER, B.Ch.E—Several years experience refinery design and operation. Seek wider responsibilities. Box M-238, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM GEOLOGIST, B. S. in Geology, 12 years U. S. experience, 5 Middle East, 1 year South America, wants work. Box M-220, The Oil and Gas Journal, Tulsa, Oklahoma.

AVAILABLE NOW—manager for independent producer, 44. Supervise all accounting, budgetary, finance functions and prepare tax returns. Field experience production and waterfloods. Box M-226, The Oil and Gas Journal, Tulsa, Oklahoma.

AMERICAN, RETIRED executive of major oil company, excellent health, 43 years experience in Brazil in administration organization and sales, Valuable contacts local producers and refiners. Interested as part-time local representative supplier of crude oil, petrochemicals, or allied lines. Write Box M-231, The Oil and Gas Journal, Tulsa, Oklahoma.

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WEST POINT GRADUATE, 29, ex-Paratroop Officer, top 1% in nation-wide College grad exam in 1952, seeks job in sales or admin with small or large house dealing in oil properties or well promotion. Some knowledge oil business, plus deep interest and drive for more. If potential exists, will go anywhere for interview or job. Experience shows I can match guts, drive, and sense anywhere. Box M-229, The Oil and Gas Journal, Tulsa, Oklahoma.

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Box M-240, The Oil and Gas Journal
Tulsa, Oklahoma

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WANT TO PURCHASE Gas and Oil Properties—Submit Reserve Estimates, Income, etc. Box M-210, The Oil and Gas Journal, Tulsa, Oklahoma.

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Box M-227
The Oil and Gas Journal
Tulsa, Oklahoma

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UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF INDIAN AFFAIRS
Crow Indian Agency
Crow Agency, Montana

Sealed bids will be received until February 16, 1961, 2:00 o'clock, P.M., Mountain Standard Time, and opened at that time in the office of the Crow Indian Agency, Crow Agency, Montana, for the leasing of 5,280.00 acres of tribal land and 1,320.00 acres of allotted lands all located in Twp. 6 South, Rge. 32 East, Big Horn County, Montana, for oil and gas mining purposes. The details of the lease offering and how and where to file bids may be obtained by addressing the inquiry to the Superintendent of Crow Indian Agency, at Crow Agency, Montana.

BUSINESS OPPORTUNITIES

OIL FIELD TOOLS and equipment sales representation for American manufacturers. Offered for Italy and North Africa especially, by Italian engineer, retiring from large company. Highest references. Italy and U. S. Address: Box 31 R 961, The Oil and Gas Journal, 4041 Marlton Ave., Los Angeles 8, California.

EXPERIENCED AND responsible driller-operator desires 7 associates to join with him in drilling 7 shallow ventures in Texas and Kansas. Clean deal. 807 West Tuckey Lane, Phoenix 13, Ariz.

FINANCIAL—Investment Banking Houses and Underwriters reached. Confidential. You can send the details of your proposition direct or thru your attorney to Consultant 817—51st Street, Brooklyn, N. Y.

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Box M-155, The Oil and Gas Journal
Tulsa, Oklahoma

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Land Office, Cheyenne, Wyoming. Notice is hereby given that 5,328.38 acres of land in 49 parcels within the known geologic structures of a number of fields in Big Horn, Campbell, Fremont, Natrona and Washakie Counties, Wyoming, are offered for competitive oil and gas leasing through sealed bids to the qualified bidder of the highest cash amount per acre at 2:000 P.M., MST, March 8, 1961, when bids will be opened. Full details of the offering, and how and where to submit bids, may be obtained from the Land Office, Cheyenne, Wyoming. Arvin H. Olswold, Chief, Minerals Section.

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The Oil and Gas Journal
Box 1260 Tulsa, Okla.

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Box 1260
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OKLAHOMA

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Sun Oil Co. 1 Doris Weaber, SE NW 18-1n-22eCM. IPF 3,700 M.c.f.d. Morrow 7,882-7,902 ft. TD?

Carter County:

Sinclair Oil & Gas Co. 1 J. C. Ratcliffe, 12-4s-3w. IPF 47 BOPD, 49 b.s. and w., W. Spring Creek 3,090-3,150 ft., Kindblade and Cool Creek 3,220-6,712 ft. TD 11,250 ft.

Garfield County:

Marion Oil Co. 1 Valtr "A", SW SW 30-20n-5w. IPF 960 BOPD, 39.5°, Meramec 6,438-6,526 ft. TD 6,526 ft. Oil discovery.

1 Henry Peach, SW NE 32-20n-5w. IPF 96 BOPD, 3,800 M.c.f.d., Cleveland 5,660-84 and Meramec 6,362-95 ft. TD 6,395 ft. Oil and gas discovery.

Garvin County:

Pure Oil Co. 1 J. B. O'Harro, SE NE SW 21-3n-1w. IP 184 BOPD, 424 bwpd, 29° and 38°, First Bromide 4,772-78 ft., Second Bromide 4,842-45 ft. TD 4,950 ft.

Kingfisher County:

Cabeen Exploration and Jones & Pellow 1 Reiswig, C NE NW 21-19n-7w. IPF 4,379 M.c.f.d., Manning 6,980-88, 6,996-7,002 ft., Meramec 7,210-7,315 ft. TD 7,400 ft.

Lincoln County:

Loyd Benefield 1 Bill Adams, NE SE NW 4-14n-2e. IPF 15 M.M.c.f.d., Hunton 4,928-33 ft. TD 5,325 ft.

Berg & Buck Drilling Co. et al. 1 Kriel, SW SW NW 33-15n-2e. IPF 2,500 M.c.f.d., Hunton 4,911-14 ft. TD 5,309 ft.

Powell Briscoe 1 Drake, C SW¼ 24-16n-2e. IP 5,123 M.c.f.d., Jones Cleveland 3,860-64 and 3,866-72 ft. TD 3,909 ft.

Major County:

Pan American 1 Houk, NE SW 8-21n-15w. IP 20 BOPD, 48°, Chester 7,485 to 7,546 ft. TD 7,606 ft.

Texaco Inc. 1 L. L. Weaver, NW NW SE 8-22n-11w. IPF 5,040 M.c.f.d., Manning 6,665-6,722 ft. TD 7,066 ft.

McClain County:

Gordon Street and Brooks Hall 1 Allison, C NW SW 8-7n-4w. IP 148 BOPD, 43°, Hart 9,410-16, 9,530-42 ft. Osborne 9,760-9,908 ft. TD 10,050 ft.

Stephens County:

An-Son Petroleum Corp. 1 Whitt, C NE SE 20-2n-6w. IP 60 BOPD, 37°, Hoxbar sand 8,265-77 ft. TD 8,520 ft.

Woods County:

Davon Drilling Co. and Ashland Oil & Refining Co. 1 Swallow, C NW SE 6-24n-13w. IPF 9,600 M.c.f.d., Cherokee sand 6,053-64 ft. TD 6,258 ft.

Panhandle Development Co., Inc. 1 Urban, SE NW 35-26n-17w. IPF 5,500 M.c.f.d., Cherokee 5,837-46 ft. TD 6,150 ft.

WEST TEXAS

Gaines County:

Union Oil Co. of California 2-1 Jones Estate, 14 miles southwest of Denver City in Sec. 1, Blk. A-8, PSL Sur. IPF 187 BOPD, plus 2% water, 36.8°, GOR 568:1, Abo 8,004-22, 8,037-62, and 8,073-80 ft. TD 8,108 ft. New oil discovery.

Howard County:

Tennessee Gas Transmission Co. 1 Virgil Graham, 19 miles northwest of Big Spring in Section 30, Blk. 33, T-3-N, T&P Sur. IPF 319 BOPD, 20/64-in. choke, 42.3°, GOR 1,035:1. TP 320 psi., packer. TD 9,115 ft. New oil discovery.

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The PVM overcomes the difficulty in obtaining 100% repeatability inherent in other types of cyclic volume meters.

The PVM is fluid packed, sampled and then counted as the liquid is discharged. Its accuracy is indisputable as to volume of liquid measured at the pressure-temperature condition of operation.

The PVM may be calibrated for an exact volume with compensation made for a given composition, temperature and pressure.

The PVM is available with Core Barrel Sampler* which will complete the requirements for metering oil field liquids. The Sampler cuts a core vertically through the liquid and deposits same in a container. Thus an exact and representative core is taken from a fixed volume. The composite sample when analyzed will give the true percentage of oil, water and/or emulsion that has been metered.

NATIONAL'S PLUS VALUE — Engineers and field service crews available from over 50 service and warehouse stocking points to size, install and service National PVMs.

* Core Barrel Sampler is a trademark of National Tank Company

It's a National®

NATIONAL TANK COMPANY

DRAWER 1710

TULSA, OKLAHOMA

New Tool Added For Standard Completions

Pow-R-Frac, a money-saving wireline fracturing service, has been added to Welex's STANDARD WELL COMPLETION services.

Designed for use in cased or uncased holes 5½" and larger, Pow-R-Frac saves you money by:

1. Reducing usual fracturing expenses; or
2. Frequently eliminating other fracturing expenses entirely.

This is *another exclusive* Welex service for well completion work.

For years Welex has led in offering the most complete selection of services for standard completions, as well as other types of completions.

Today Welex's Super Dyna-Jet*, one of the standards of the industry, is the finest perforating gun available. Other Welex *"standards of the industry"* for standard well completions include Link-Jet* and Torpedo-Jet*.

Welex also offers the most complete choice of auxiliary services for standard completions:

- Gamma-Neutron Surveys
- Correlation Gamma Surveys
- Wireline Bridge Plugs
- Production Packers
- Welex Bear Gun
- Squeeze Cementer
- Flowmeter Surveys
- Jet Pipe Cutter

No other company offers such a complete package.

These services, coupled with Welex's years of experience in every type of completion, make Welex your best choice every time.

COMPLETE WIRELINE Welex SERVICES

WELEX

A Division of Halliburton Company

General Offices. 1728 Old Spanish Trail, Houston, Texas

**Trademark of Jet Research Center, Inc.*

OSC-3AJ

-the jet bit with built-in speed... and records prove it!

The Hughes OSC-3AJ is fast . . . it's rugged, and it's versatile. Some of the records set with the OSC-3AJ are spectacular. As an example, a Gulf Coast well was recently drilled to 10,000 feet in 3 days and 7 hours: actual rotating time — 46 hours. Only five bits were used; one 12¼" and four 9⅞".

The previous record for a 10,000-foot well in this area was made with Hughes OSC-3J's. We don't pretend that the penetration rate or footage drilled in the record well is par for the OSC-3AJ. But one thing this record does prove is the outstanding performance built into the bit.

The Hughes OSC-3AJ was originally designed for "top hole" digging. But its exceptional performance in low-strength, high-drillability formations and its availability in a wider range of sizes is extending its use to greater depths and in an increasing number of areas of the world.

Ask the Hughes man in your area about the performance you can expect with the OSC-3AJ

HUGHES TOOL COMPANY ORIGINATOR

AND WORLD'S LEADING DEVELOPER OF CONE-TYPE ROCK BITS